Request For MY 2012 Through MY 2016
GHG Credits for Advanced Technologies

Petition and Supporting Attachments

PUBLIC VERSION

CONFIDENTIAL BUSINESS INFORMATION REDACTED

REQUEST FOR MY 2012 THROUGH MY 2016 GHG CREDITS FOR ADVANCED TECHNOLOGIES

I. INTRODUCTION

Pursuant to 40 CFR § 86.1869-12(d), Mercedes Benz, USA (on behalf of its parent Daimler, AG herein jointly referred to as "MB") hereby submits this request for start-stop greenhouse gas (GHG) credits pursuant to EPA's off-cycle credit program as specified further in Section III below. MB also requests GHG credits in the amounts set forth at 40 CFR § 86.1869-12(b) for the following technologies: High Efficiency Exterior Lighting; Thermal Controls – Infrared Glazing; and Thermal Controls – Active Seat Ventilation. *See* Section IV below.

The MB specific GHG credit request for start-stop technology is based on real-world driving data collected from MB customer vehicles using active satellite vehicle monitoring. MB has determined that the idle time for six models in its fleet exceeds the idle time values used as the basis for EPA's pre-approved GHG credit menu. *See* 40 CFR § 86.1869-12(b)(1)(v). Pursuant to the alternative demonstration requirements set forth at 40 CFR § 86.1869-12(d), and utilizing the general calculation methodology previously established by EPA in creating the start-stop off-cycle credit, MB is seeking engine idle start-stop credits of 11.0 g/mi for each qualifying small-size car, 9.1 g/mi for each qualifying mid-size car, 19.0 g/mi for each qualifying large size car, and 17.1 g/mi for each qualifying truck in MB's fleet for Model Year (MY) 2012 through MY 2016. These credit values are supported by the data and statistical analysis attached to this petition.

As recommended in 40 C.F.R. § 86.1869-12(d)(1), MB met with and had informal discussions with EPA to inform the Agency regarding MB's proposed methodology and analytical plan and the scope of data that would need to be submitted. *See also* 77 Fed. Reg. 62,623, 62,838 (Oct.

15, 2012). MB indicated that it was preparing a request for an MB model specific engine idle start-stop credit using the same analytical approach EPA used to establish the pre-approved GHG credit menu in the August 2012 Joint Technical Support Document issued as part of the 2017-2025 GHG and CAFE rulemaking (hereinafter Joint TSD). MB informed EPA it would be supporting its request with statistically significant real-world driving data collected from a representative sample of its customers. MB also indicated it would be requesting off-cycle GHG credits, in amounts previously approved by EPA, for its MY 2012 and 2013 vehicles which contain the EPA identified off-cycle technologies. EPA requested that MB conduct additional vehicle testing to provide an MB-specific amount for the on-cycle GHG benefit of start-stop, and that MB attempt to obtain independent, third-party verification for the representativeness of its real-world idle time data. This petition incorporates those additional testing results and provides independent verification for MB's real-world driving data as summarized in the Statistical Assessment Report at Attachment A.

EPA's off-cycle credit program recognizes that the standard 2-cycle test protocol may not accurately reflect the real-world GHG reduction benefits from certain technologies. The program is designed to incentivize those technologies by recognizing actual GHG benefits that would otherwise be unaccounted for when compliance with the GHG standard is measured on the 2-cycle test. The off-cycle credit program also recognized that for some technologies, EPA's 5-cycle test would also fail to account the full GHG reduction benefits. *See* 77 Fed. Reg. at 62,838. This is particularly true for technologies like start-stop whose effectiveness depends on the amount of idle time experienced in the real world. Since the aggregate idle times for vehicles tested in the 5-cycle test methodology are not based on measured MB idle times, the emission benefits of start-stop technology are not accurately measured under this method. The GHG benefits of engine idle start-stop technology in the MB fleet are best reflected by an alternative demonstration methodology that utilizes the approach EPA adopted to place the technology on the pre-approved menu but incorporates real world idle time data from MB customers and MB specific on-cycle reduction data. In addition, MB is requesting GHG credits for vehicles equipped with other technologies pursuant to EPA's pre-approved credit menu.

II. DESCRIPTION OF MB 2010-2011 TEST PROGRAM

As part of its continued commitment to product development and enhanced energy management and fuel economy for its next generation of vehicles, MB conducted a study of real-world driving behavior in the United States (U.S.) during 2010-2011. The study was conducted to better understand U.S. customer driving behavior and its effect on energy management and in-use fuel economy and to enable MB to better develop systems for its own customer demographic and to maximize real world benefits. The study involved a test fleet of 30 MY2010 vehicles representative of the MB fleet in the U.S. Test program data was collected for over a year covering a number of vehicle operating parameters. Two of the critical parameters that were continuously monitored were engine rpm and vehicle speed. The data from these monitors allow the amount of idle time experienced by each vehicle to be determined. The study yielded complete results from 29 of the 30 test vehicles.[1] The U.S. 2010-2011 test program provides robust data that are highly representative of the real-world driving patterns of MB customer vehicles.

A. Background Leading Up to the U.S. Test Program

The 2010-2011 MB test program had its origins in an MB research program that dates from 2006. In 2006, MB's Energy Management Program (EMP) began to gather information and research potential new technologies, including engine idle start-stop, to address GHG emissions targets which were beginning to develop within the European Union. Between 2006-2007, MB had a team of technical experts and engineers working on advanced GHG emission reduction technologies. By March 2007, MB displayed its first advanced technology C-Class model at the Geneva Motor Show. Although technological development was underway, the EMP had several open issues that required in-use operational data in order to assure both the proper deployment of technology and customer acceptance of such technology. First, the EMP team recognized the need to develop

[1] One vehicle experienced recurrent technical difficulties with the data collector and could not complete the test program.

and/or acquire instruments to evaluate energy flow within a vehicle. Second, the EMP team continued to strive to develop additional devices to maximize driver controlled opportunities for emission reduction (e.g., a vehicle ECO button option). Finally, the EMP team determined it needed more data on real-world driving from MB's fleet of customer vehicles to better assist with maximizing GHG reduction potential in MB's next generation vehicles.

B. Developing a Strategy for Obtaining Real-World Driving Data

By April 2008, planning for a U.S. field test was underway. Building on experience and information gained from a 1995 European field test, the EMP team began to formulate design parameters for a new field test to gather real-world driving data. The 1995 data provided only generalized information on driving patterns, such as velocity and acceleration patterns. The EMP team recognized that additional vehicle and operator specific data was required to judge the potential effectiveness of various technologies. Accordingly, the EMP team utilized more advanced data collection and reporting equipment to design an operational strategy for further quantifying real-world driving patterns for its 2010-2011 test program.

C. The MB 2010-2011 Test Program Design Principles

In designing the 2010-2011 study according to best engineering practices, the EMP team determined that three principles were critical to obtaining high quality and representative field data:

1. *Voluntary customer enrollment and participation in the program.* As EPA knows, locating owners willing to participate in vehicle test programs with their own personal vehicles is one of the biggest challenges to any field test. Rather than "cold-calling" or blindly reaching out to U.S. owners, MB utilized a combination of its dealership network and its CAP2000 database to identify MB owners willing to participate in the program. A financial incentive of $1000

($500 payable at the beginning of the program and $500 paid at the end of the program) was provided each participating owner.

2. *Use of inconspicuous data gathering technology*. Any instrumentation installed in the test vehicles must be unseen by the owner/driver and have no discernible impact during vehicle operation. If out of sight, the study can eventually be "out of mind" and the customer can "forget" about the study and will drive normally during the study period. Accordingly, test program vehicles were equipped with a Micro Flea data logger, as described below.

3. *The period of data collection must be at least one year*. In the case of the MB 2010-2011 study, the average period of data collection was approximately 13 months, which allowed for collection of high quality data that were representative of individual drivers' average vehicle usage.

These fundamental principles remain valid today in MB field tests conducted world-wide in areas such as the EU and China and field results continue to verify the accuracy and reliability of the 2010-2011 test program data.

D. Target Vehicles and Operational Location

By July 2009, operative planning for the U.S. field test had begun. In order to assemble a test fleet of representative vehicles selected according to best engineering practices, the EMP team reviewed U.S. vehicle sales distribution statistics by state, dealership, and vehicle model class for MY2008 and MY2009 (year-to-date as of the time of the study's design in Summer 2009). Based on the foregoing sales data, the test program team first selected a target mix of vehicle classes to represent U.S. sales. *See* Car Line Selection Table at Attachment B. Then, based on sales data from the top 100 MB dealerships with large sales and service histories, the test program team established representative location targets. The targets for each location included numbers of vehicles and vehicle model classes from 8 states that, at the time, accounted for approximately 65% of U.S. MB sales.[2] In addition to considering MB's geographic distribution of sales, the identified vehicle locations also were distributed across the U.S. to obtain coverage of a range of climate (hot, cold, dry, wet) and terrain (coastal, mountainous, plains) factors.

With targets set for a test fleet that would generate a large and robust data set representing the MB vehicle fleet, the test program team began the process of customer vehicle recruitment. Field tests for gathering customer driving data require voluntary customer participation and installation of instrumentation on customer vehicles. Recruiting test vehicles is challenging and can face decline rates of up to 100:1 to 1000:1. Utilization of the dealership network to recruit customer vehicles can contribute to a more favorable decline rate, a more timely test program, and indeed, was critical to implementing the MB 2010-2011 field study which experienced a decline rate of less than 20:1.

For the MB field study, the recruitment methods differed in the western and eastern regions of the U.S. In the western region of the U.S., working with its Los Angeles Tech Center, MB contacted 2 dealers in San Francisco, 2 in Los Angeles, 1 in San Diego, and 1 in Phoenix. Being in the top 100 dealers, each dealer maintained a sufficient daily flow of customer service appointments to provide a large and varied vehicle population from which to identify customers willing to participate in the test program. In the eastern region, MB utilized a list of customers who had previously agreed to participate in CAP2000 emissions testing as potential test participants. Each of these customers was sent a letter (also used in the western region) asking if they would consider participation in the field study. Specific recruitment efforts for each region are set forth in greater detail below.

Western Region: Potential customer volunteers for the California and Arizona target vehicles were contacted when they brought their vehicles in for service. Dealers were given guidance on the target number and model mix of vehicles needed from their dealership, based on the Test Vehicle Selection Matrix set forth in Attachment B. The dealers then approached

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[2] *See* Attachment B (Test Vehicle Selection Table and Matrix). These same states represent 69% of U.S. MB sales as of 2012.

potential customer volunteers who had vehicles matching the vehicle class targets and were in the service department of the dealership, or were coming in for service. If a customer did not consent to participate in the study, the dealer approached the next customer matching the vehicle class target that presented him or herself at the dealership for service.

MB estimates that dealers approached approximately 20-30 customers per dealership, or 120-180 customers in total, during recruitment. Dealers were asked to assure that owner-offered vehicles did not appear, from maintenance records, to represent atypical driving patterns (*i.e.*, particularly low or high annual mileage, third car driven only infrequently for recreational purposes). As customer vehicles committed to participate in the study, dealers were given updated information on the remaining number and model mix of vehicles to recruit, as described further below, until the targeted number of western vehicles (13) was achieved.

Eastern Region: In the eastern region, potential customer volunteers were recruited by mail. Invitation letters (in the form of the consent letter described below) were sent out to MB customers identified in the CAP2000 database, who had previously volunteered their vehicles for purposes of compliance testing. The consent letters were sent out in batches of 30-100 per mailing and 350 letters were sent out overall. MB received approximately 30 responses. Of these responses, 17 were "positive" responses in that they were willing to participate and had a vehicle meeting the necessary target mix.[3] As in the western region, as customer vehicles committed to participate in the study, the next batch of invitation letters was then sent out to customers with vehicles or profiles meeting the remaining target mix, until the targeted number of eastern test vehicles (17) was achieved.

Once identified, either by the dealers (in the West) or through the CAP2000 database (in the East), potential customer volunteers who expressed willingness to participate in the test program were asked to execute the consent letter describing the "Parameter Measurement for Energy

[3] These 17 vehicles included one vehicle that eventually did not want to participate in the study and one vehicle that was added to replace the cancelled vehicle.

Management Program." *See* Attachment C (Owner Letter). Customers were told that MB "would like to collect certain driver and vehicle parameters, such as throttle position, steering angle, AC usage, rpm ranges, gear selection, engine oil and coolant temperatures during U.S. customers normal day-to-day vehicle usage." *Id.* Customers were not told that the data would be used to calculate idle time or the potential for GHG emissions reduction, but were told that the data "would only be used to determine and analyze how overall vehicle energy management can be optimized, based on U.S. customer driver behavior." *Id.* As previously noted, customers were offered two payments of $500 each as a financial incentive and were indemnified against any potential damage that might be caused to the vehicle in connection with the installation and removal of the data-loggers.

Customer volunteers also were asked to complete a questionnaire to provide basic profile information (which allowed the project team to ascertain gender, age, geographic location and vehicle model information) and to self-describe individual driving behavior details (*i.e.*, estimated annual mileage, driving style of active vs. passive driver, commuter distance, type of commuting (stop & go or flow), and time of day of commuting). *See* Attachment C (Customer Questionnaire).

If a potential customer volunteer consented to participate in the study by signing and returning the consent letter with questionnaire, these response forms, from both the western and eastern regions, were reviewed by the project team. In some instances, where the questionnaire responses were incomplete or where customers signed the consent letter but indicated they would be more comfortable providing the questionnaire responses over the phone, telephone interviews were conducted by project team members to obtain further information.

Potential customer volunteers and their vehicles were screened only minimally during recruitment, primarily to ensure that the vehicles met the targeted profiles for location and vehicle class, were not "third car" or recreational-only vehicles, and were close to the requested driving mileage of 10,000 miles/year. The project team monitored the gender mix and average age of the test fleet as it was recruited to assure that it tracked the typical profile of MB customers. The customer-provided information on individual driving behavior was collected to support later interpretation of the data and was not used in screening test participants. The process of screening potential test participants was an iterative one that at all times attempted to select a test fleet that was representative of the MB customer fleet in the U.S. (according to driver age, gender, location, and annual mileage accumulation). Once a customer vehicle was accepted into the test program, it was instrumented with the data logger by their dealer and began data collection, while recruitment of other vehicles for the program continued.

With regard to the western test vehicles, the vehicles present in a dealership's service bay on any given day amount to a customer-determined random selection of the fleet of similar vehicles that are driven in the dealership's service territory. Test participants were recruited blindly from this population except for the screening by the dealerships based on maintenance records to avoid vehicles with atypical driving patterns. The methods used to recruit the western test fleet should lead to a representative sample of the vehicle fleet and their owners in the dealership's service territory, in much the same way that a formal random sample would accomplish.

With regard to the eastern test vehicles, the vehicles present in the CAP2000 database are the result of a formal random sample drawn from vehicle registration records according to the vehicle recruitment methodology in EPA's regulations,[4] and were accepted by EPA as representative of the fleet of MB vehicles in the U.S. As in the western region, test participants were recruited blindly from this population except for the screening by the dealerships based on maintenance records to avoid vehicles with atypical driving (annual mileage) patterns.

As described below and in Attachment A (Statistical Assessment), the methods of vehicle recruitment in both western and eastern regions lead to

[4] *See* 40 C.F.R. Part 86, Subpart S, Appendix I (Vehicle Procurement Methodology); *see also* 64 Fed. Reg. 23,906, 23,972 (May 4, 1999).

a representative sample of the MB vehicle fleet in all 50 States. Neither MB nor the dealerships exercised control over the opportunity of customers to participate in the study (except through the noted screening for average age and mileage patterns and indirectly through the choice of geographic locations where vehicles were recruited).

With respect to the demographics of the study fleet, women accounted for 30% of drivers compared to 39% of all MB owners. The study fleet drivers averaged 47.5 years of age, while the median age of all MB owners is just over 50 years. The gender and age demographics of the study fleet are close to the demographics of all MB owners. The vehicle mileage of the study fleet also is representative of MB's U.S. vehicles. *See* Attachment A (Statistical Assessment).

Nevertheless, demographics in general will have a lesser effect on the idle fraction than for other driving characteristics, as discussed in Attachment A (Statistical Assessment). Additionally, sample size is not the sole criterion for representativeness of the data, and the duration of data collection may be more important. The longer the duration of the test period, the more likely one will see a representative range of trip characteristics, including commute travel, weekend and vacation trips. Durations of one year or more are needed to assure that one observes the full range of annual travel is observed <u>and</u> the full range of climatic and weather effects on trip characteristics. With regard to these factors, the duration of MB's test fleet data collection (for an average of 13 months) ensures robust and representative results.

E. Data Collection Equipment and Procedures

For the 2010-2011 MB test program, 30 customer vehicles from 6 model classes were identified across 8 states in the U.S., representing a mix of geographic and climatic conditions, as well as different driving behaviors, across the U.S. Only 29 vehicles completed the data collection, as one vehicle experienced technical problems. *See* Attachment B (Test Vehicle Selection Tables). The test fleet vehicles were stratified geographically and by model class to achieve a sample fleet that is representative of total MB sales in the U.S. for MY 2012 and later vehicles. *See* Attachment A (Statistical Assessment).

Micro Flea data-loggers[5] were installed in the test vehicles pursuant to MB's Micro Flea Installation Manual. *See, e.g.*, Attachment D (Instruction Manual for Micro Flea 204 Installation). During the field study, data were collected from each of the 29 vehicles. A summary of the duration of data collection for each of the test vehicles is provided at Attachment F. The Micro Flea boxes collected data on several driving parameters—including throttle position, steering angle, AC usage, rpm ranges, gear selection, engine oil and coolant temperature—during U.S. customers normal day-to-day vehicle usage at frequencies of 10 Hz, 5 Hz, 1 Hz, and 0.1 Hz. Data from 40 signals were measured and recorded, either continuously or when their value changed. A list of the data signals recorded is provided in Attachment G.

Two of the critical parameters that were continuously recorded were engine rpm and vehicle speed. From these data, the amount of idle time experienced by each vehicle could be determined, as further described below in Section III.

III. <u>REQUEST FOR MB VEHICLE SPECIFIC START-STOP GHG CREDITS</u>

Based on the foregoing description of the MB study program and results, the following sections and supporting documentation describe the methodology and justifications for the MB vehicle specific GHG start/stop credit. Section III.A explains why the MB start-stop credit proposal meets the general requirements of the off-cycle credit program. Section III.B provides a justification for seeking off-cycle credits via an alternative demonstration methodology. Section III.C.1 explains the proposed alternative off-cycle credit methodology in detail and presents supporting data. Finally, Section III.D addresses the information requested by 40 CFR § 86.1869-12(e)(2)'s off-cycle credit application requirements.

[5] A description of the Micro Flea data logger is available at Attachment E (Car Media Lab Data Sheet on "The Micro Flea" Basic Telematics Unit).

A. The MB engine idle start-stop technology meets the general requirements of the off-cycle credit program and EPA's definition of engine idle start-stop technology.

In order to qualify for off-cycle credits, any proposed technology "must have a measurable, demonstrable, and verifiable real-world CO_2 reduction that occurs outside the conditions of the Federal Test Procedure and the Highway Fuel Economy Test." 40 CFR § 1869-12(a). Start-stop technology is well recognized as a technology that effectively reduces GHG emissions under conditions that occur "outside the conditions of the Federal Test Procedure and the Highway Fuel Economy Test." Indeed, by including engine idle start-stop technology on the menu of pre-approved credits, EPA has already recognized that start-stop technology meets the general programmatic requirements of 40 CFR § 1869-12(a).

The MB start-stop technology is fully consistent with start-stop technology EPA has already included in the off-cycle program. A full description of MB's start-stop technology is provided in Attachment H. Consistent with EPA's definition, MB vehicles equipped with start-stop technology have their engines turned off at rest and are restarted once pressure is applied to the accelerator or the brake is released. *See* 40 CFR § 1869-12(b)(4)(iii). Each start-stop vehicle also is equipped with a 12V electric heater pump system to circulate heated air to the cabin whenever the engine is stopped during a start-stop event, as required by EPA. *See* Attachment I (Graphic Representation of Design and Part Installation of MB Start-Stop System); *see also* Attachment J (Bosch Electric Heater Description Sheet).[6] MB's start-stop vehicles represented in this Petition do not have an electric AC compressor.

As a brief summary of the description provided in Attachment H, the start-stop system is enabled when certain vehicle conditions are met, such as

[6] Per EPA's requirements, the heater system is "calibrated to keep the engine off for a minimum of one minute when the external ambient temperature is 30° F and when cabin heating is enabled." 40 CFR § 86.1869-12(b)(4)(xii). See also discussion of the electric heater circulation system the Joint TSD at 5-89, and 5-95 to 5-96.

the vehicle has reached a speed of 5 mph after the initial key start, the vehicle is in Drive or Neutral, the brake is pressed, the engine hood and driver door are closed, and the vehicle is standing still. *See* Attachment H. MB start-stop vehicles are equipped with a supplemental 12V power net system that is dedicated to assuring functionality of all electrical components and safety functions during engine restart. This allows the main battery to be available for engine restart.[7] *See id.* at 7.

Accordingly, this supplemental battery system enables automatic stop (engine off) while the vehicle is stopped and the heater or AC system and other electrical components are active. Without the supplemental battery a drop in the power supply would occur upon engine restart, which would negatively impact customer acceptance and usage of start-stop. Recent independent testing of various start-stop performance characteristics rated the Mercedes system as number 1 in performance. *See* Attachment K (Excerpt from German Magazine AutoBild) (rating MB C350 number 1 out of 13 start-stop vehicles tested).

Additionally, the operation of climate control (AC or cabin heating) systems does not automatically disable start-stop. When engine stop is activated through the MB start-stop system, the MB climate control system automatically closes the outside air circulation vents to assure warm outside air does not circulate in the vehicle. In addition, the system continues circulating cool air in the cabin while the engine remains off. In order to measure the impact of the entire energy management system, including the climate control system, on start-stop, MB conducted an FTP test with an outside temperature of 95°F and an interior temperature of 72°F. The results indicate that the energy management system for all electrical components, including cooling fans and air recirculation, caused the start-stop system to be 88% as effective compared to normal FTP test conditions.

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[7] As part of the A/B testing conducted to support this Petition, described below, MB measured the impact of the MB start-stop system on the main battery before and after the FTP tests under both normal conditions (AC off, no solar heat) and hot climate conditions (at 95°F). The results indicate that the main battery maintains its state-of-charge throughout the A/B testing for both the normal and 95°F FTP tests.

Finally, since start-stop technology is a system that prevents engine operation in certain circumstances and has no effect on engine or emission control durability, there is no deterioration that must be accounted for pursuant to 40 CFR § 86.1869-12(d). To demonstrate durability and in-use reliability of its start-stop technology, MB is conducting on-road and bench tests on over 100 start-stop vehicles. MB's durability program is nearly complete and no failures have been observed. For the on-road tests, 112 vehicles (out of 192) have completed the durability runs, and zero outages occurred. For the bench tests, 31 vehicles (out of 41) have completed the durability runs, and zero outages occurred. *See* Attachment L (Durability Information Presentation).

B. The off-cycle CO_2 benefits of engine idle start stop technology are best demonstrated using the alternative EPA-approved methodology.

The off-cycle credit program allows manufactures to seek off-cycle credits in three ways: (1) as credits from the pre-approved technology menu; (2) as demonstrated by the 5-cycle methodology; or (3) as demonstrated by an EPA-approved alternate methodology. Alternate credit values for technologies already listed on the pre-approved menu, like engine idle start-stop technology, may be sought through either the EPA 5-cycle methodology, *see* 40 CFR § 86.1869-12(c), or an alternative EPA-approved methodology. *See* 40 CFR § 86.1869-12(d).

MB agrees with EPA's general methodology for calculating the GHG benefits of start-stop technology. In support of this request, MB provides its own alternative demonstration methodology pursuant to 40 CFR § 86.1869-12(d). MB's proposed credit methodology follows the same type of analysis EPA used in deriving the pre-approved menu as set forth in the Joint TSD (5-84 to 5-95) and as suggested by EPA in its rulemaking preamble. *See* 77 Fed. Reg. at 62,838. The critical difference is that while EPA's calculation was based on idle times estimated from national studies and the Motor Vehicle Emissions Simulator (MOVES) model data, MB collected its own real-world data to record actual idle times across a representative sample of its fleet.

C. MB has demonstrated that a larger off-cycle credit amount is appropriate for its start-stop equipped vehicles.

In support this off-cycle credit application, MB submits real-world driving data from the representative test fleet of MB customer vehicles described above. MB also submits MB specific 2-cycle GHG improvement data (aka "A/B testing" data), to further support this request. When the MB specific data are utilized with the methodology EPA developed to calculate off-cycle credit values for engine idle start-stop technology on the pre-approved credit menu, the result is that MB vehicles should be eligible for the following start-stop off-cycle credits: 11.0 g/mi for each qualifying small-size car; 9.1 g/mi for each qualifying mid-size car; 19.0 g/mi for each qualifying large size car; and 17.1 g/mi for each qualifying truck.

As described below and in the attached supporting documents, MB's data and methodology are fully consistent with EPA's analysis in the Joint TSD. In further support of MB's real-world data and methodology, MB submitted the Company's test program design and results to an outside statistician with extensive experience in mobile source modeling. The results of this statistical analysis are set forth in Attachment A (Statistical Assessment Report). The statistical analysis confirms both the representativeness of the MB test fleet and the resulting real-world idle times for MB vehicles.

1. Analytical methods used to determine the proposed off-cycle credit amount.

In determining an analytical approach for calculating the MB vehicle GHG reductions from start-stop technology, MB followed the analytical process described in the Joint TSD accompanying the 2017-2025 GHG and CAFE rulemaking combined with MB vehicle specific data. The process and results are described below.

The Joint TSD approach may be summarized as follows: (1) use the MOVES simulation tool to estimate the percentage idle time experienced in real world driving conditions; (2) estimate the percentage of time where start-stop will operate to eliminate fuel consumption, called the "idle fraction eligible for Engine-off"; (3) use the EPA Advance Light-Duty Powertrain and Hybrid Analysis Tool (ALPHA) model to estimate the amount of fuel saved by start-stop during the 2-cycle test for different vehicle classes; (4) use the difference between the amount of idle time on the 2-cycle test and the idle fraction eligible for engine-off to scale the APLHA savings estimates to a real world result; and (5) calculate the credit amounts for light-duty vehicles and trucks by taking a weighted average of each vehicle class according to overall U.S. fleet data.

This application for off-cycle credits follows each of these analytical steps but uses MB specific data as appropriate to reflect actual customer driving patterns and MB system technology. Each step is described below.

a. Estimate the total percentage of idle time experienced in real-world driving conditions.

For the 2-cycle test, EPA estimated an idle rate of 10% based on an actual idle rate of 10.7% after accounting for engine operating conditions. *See* Joint TSD at 5-86. This contrasts with a total real-world idle time estimate of 13.76% from EPA's MOVES simulation data. *See id.* EPA also highlighted evidence in the Joint TSD that "idle rates could be higher than the 13.76% estimated from MOVES," and referenced other studies with idle fraction rates of 22% and 17%. Joint TSD at 5-86.

As detailed further in Attachment A (Statistical Assessment) and explained below, MB fleet data demonstrate an average real-world idle time of 23.83%. These data are fully supported by independent idle data, from Progressive Insurance Co., representing an additional 17,000 MB vehicles in the U.S. *See* Attachment A. Accordingly, MB used its real-world idle time of 23.83% to quantify the off-cycle benefits of engine idle start-stop technology in this proposal.

b. Calculate the idle fraction eligible for engine-off.

Start-stop technology will not be uniformly engaged under all idling conditions. The idle fraction eligible for engine-off quantifies the total percentage of vehicle operation where engine idle start-stop technology is active and may be calculated by multiplying total idle time by the percentage of idle time where start-stop technology is enabled. EPA calculated this value by multiplying the MOVES based real-world idle time estimate, 13.76%, by an estimated engine idle active percentage of 87.75%. *See* Joint TSD at 5-89. The Agency estimated that start-stop technology is active during approximately 87.75% of total real-world idle time, which resulted in an estimated real-world idle fraction eligible for engine-off of 12.07%. *See id.*

The MB off-cycle credit calculation takes the same analytical step to arrive at the idle fraction eligible for engine-off. However, the calculation uses MB specific fleet survey data in place of simulated data for real-world idle time and applies MB specific system design parameters to EPA's adjustment factors to estimate engine-off eligibility in the real world. MB, working from the measured, real-world idle time average of 23.83%, arrives at 21.22% for a real-world adjusted idle fraction eligible for engine off. The process leading to this determination is summarized as follows.

To calculate what portion of MB's real-world idle time (23.83%) is eligible for start-stop, MB followed EPA's methodology in the Joint TSD to calculate a real-world adjustment factor based on MB's vehicle specific attributes that affect start-stop functionality in-use. In developing MB's real-world adjustment factor, the company began by reviewing the EPA MOVES data on vehicle miles traveled (VMT) and temperature. *See* Joint TSD at 5-87 and Table 5-28 (provided below). The MOVES database reflects the average U.S. fleet in terms of mileage and operating temperature. MB vehicles are included in the MOVES data. Accordingly, MB adjusted the MOVES database but limited in-use operating conditions based on MB specific design operating parameters as described below.

Table 5-28 MOVES data of vehicle miles traveled (VMT) as a function of ambient temperature.

VMT	tempAvg	Fraction	Temp Range VMT Fraction
1181.656796	-25	0.00000157	
4400.79767	-20	0.00000585	
12905.217	-15	0.00001714	
40874.20742	-10	0.00005429	
174939.1854	-5	0.00023235	
762497.0884	0	0.00101274	
1915732.576	5	0.00254446	
4924729.91	10	0.00654097	
12353230.63	15	0.01640743	0.21958689
23259876.93	20	0.03089353	(< 40 deg F)
31418211.75	25	0.04172934	
41033016.47	30	0.05449962	
49426375.28	35	0.06564760	
55404781.78	40	0.07358805	
60396251.48	45	0.08021767	
63018086.25	50	0.08369996	
68380740.42	55	0.09082259	
73176481.47	60	0.09719224	0.68343503
72473451.14	65	0.09625848	(> 40 deg F, < 80 deg F)
67073984.17	70	0.08908697	
54637578.9	75	0.07256906	
39382139.05	80	0.05230695	
24182451.73	85	0.03211888	
7635253.418	90	0.01014106	
1203687.536	95	0.00159873	0.09697809
593360.565	100	0.00078810	(>80 deg F)
18352.30991	105	0.00002438	
752904571.9	TotalVMT	1.00000000	

Based on Table 5-28 above, the following VMT percentages of the MOVES database are represented by the 3 different temperature zones as described in Table 1 below. *See* Joint TSD at 5-87.

Table 1.

	Low temp zone <40°F	Mid temp zone 41°F to 80°F	High temp zone >80°F
Fraction of VMT in Temp Zone	21.95%	68.75%	9.70%

MB analyzed MB vehicle operation in the 3 temperature ranges noted above based on actual MB start-stop operating system parameters as follows:

Cold-Temp Zone: For the cold temperature range, EPA assumed that the cold temperature range included all VMTs below 40°F. The MB start-stop system is, however, operational only in the temperature range between 14°F and 104°F (-10°C and 40°C). Accordingly, the MB cold temperature VMT availability had to be adjusted downward. This correction led to the reduction in start-stop availability of MB vehicles to 20.92% of VMT for the MB fleet in the cold temperature range compared to EPA's estimated 21.95% availability.

To account for potential unavailability of start-stop during vehicle warm-up periods, EPA further adjusted the portion of cold temperature range VMT eligible for start-stop based on two factors: (i) the percentage of time when the engine is cold and trip time is less than 5 minutes; and (ii) the percentage of time in the field that extended idle would occur to support cabin heating demands. *See* Joint TSD at 5-88.

(i) To determine the first factor, EPA identified the percentage of time when the engine is cold (49% based on the Agency's SFTP study) multiplied by a percentage of trips with trip time less than 5 minutes (25% based on MOVES data). Therefore, EPA assumed start-stop would not be active for trips in the real world with a trip length of 5 minutes (324 seconds) or lower, which amounted to a downward adjustment factor of 12.25% (or 49% x 25%). *See* Joint TSD at 5-88. MB fleet survey data demonstrate that 26.5% of MB vehicle trips had a trip time less than 5 minutes. Accordingly, MB reduced its start-stop availability by utilizing the MB in-use figure of 26.5%, which resulted in an adjustment factor of 12.985% (0.49 x 0.265).[8] This is term [a] in the calculation formula below.

(ii) To determine the second factor, EPA specified that 5% of the 21.95% cold range VMT, or 1.1%, would have extended idle of greater than 5 minutes for cold weather warm-up and this time would not be eligible for start-stop operation. MB believes this assumption is too high for

[8] Reducing the availability of start-stop to account for MB trip times less than 5 minutes (324 seconds), also accounts for the interaction of OBD with the start-stop system that was identified in the A/B on-cycle testing described below in Section III.C.1.c.

Mercedes customers as they normally have garages and MB vehicles are not equipped with remote starters. As a conservative approach, however, MB has accepted this reduction in EPA's second adjustment factor. This is term [b] in the calculation formula below.

As demonstrated by the following calculation, these calculations lead to a lower, MB specific cold temperature range VMT percentage of 17.98% compared to EPA's adjusted cold range of 19.02% VMT:

$$MB_{coldtemprange}\ VMTs = 20.92\% \times (1-(a+b)) = 0.2092 \times (1-(0.12985 + 0.011)) = 0.1798$$

Mid-Temp Zone: For the mid-temperature range, between 40°F and 80°F, EPA assumed all VMTs are available for start-stop. *See* Joint TSD at 5-87. A review of MB start-stop operating parameters indicates that the MB start-stop system is operational in all mid-range temperatures between 40°F and 80°F. *See* Attachment H. However, MB did adjust the mid-temperature range VMTs to eliminate trips of 170 seconds or less, to account for the OBD and start-stop interaction identified in the A/B testing discussed below in Section III.C.1.c. Accordingly, MB estimated that only 94.25% of the mid-temperature range VMTs were available for start-stop, resulting in an MB specific mid-temperature range VMT percentage of 64.80%.

Hot-Temp Zone: EPA assumed that all of the 9.7% VMT in the hot temperature range (>80°F) were not eligible for start-stop as the system would not work when the AC is operative. *See* Joint TSD at 5-87 to 5-88. EPA acknowledged, however, that it is possible that certain technologies could be employed to allow engine-off during hot range idles while AC is demanded.

As described above, MB vehicles are equipped with climate control systems that do not automatically disable MB's start-stop system. In hot temperature ranges, when the engine stops and the AC is operating, the MB climate control system automatically closes the outside air circulation vents to assure warm outside air does not circulate in the vehicle. In addition, the system continues circulating cool air in the cabin while the engine remains off. In order to measure the impact of the entire energy management system, including the climate control system, on start-stop, MB conducted an FTP test with an outside temperature of 95°F and an interior temperature of 72°F. The results indicate that the energy management system for all electrical components, including cooling fans and air recirculation, caused the start-stop system to operate 88% of the time under hot climate conditions compared to an FTP under normal test conditions (AC off, no solar heat). Thus, MB has calculated a hot temperature range VMT percentage of 8.54% (which is 88% of 9.7%) of VMT in the hot range being eligible for start-stop, as compared to EPA's 0% assumption.

Table 2 below provides an overview of MB VMT percentages according to temperature zone and adjusted to account for MB specific operational specifications.

Table 2.

	Low temp zone	Mid temp zone	High temp zone
MB Specific System Design	**14°F to ≤40°F**	**>40°F to ≤80°F**	**>80°F to 104°F**
Fraction of VMT in Temp Zone Based on MB System Design	20.92%	68.75%	9.70%
Adjustment Factors	0.12985 0.011	0.9425	0.88
Adjusted Fraction of VMT in Temp Zone	17.98%	64.80.%	8.54%

Based on the data set forth above, MB calculated a real-world adjustment factor as follows:

Adjusted real-world (survey) % idle time =

Real-world % idle time x (0.6480 [mid-temperature range] + 0.1798 [cold temperature range] + 0.0854 [hot temperature range])

Real-world off-cycle % idle time x (0.9132) =

23.83% x 0.9132 = 21.76%

To this adjusted real-world 21.76% idle time, MB incorporated two additional limiting factors to further reduce real-world start-stop availability. First, MB vehicles equipped with start-stop have a disable button installed in the vehicle (the ECO Button). Survey data from Europe show that this start-stop disable feature is used less than 1% of the time. *See* Attachment M.[9] Second, the MB start-stop system has a maximum engine stop duration of 3 minutes. *See* Attachment H. Data from the MB U.S. fleet study show that 98.5% of idle times are shorter than 3 minutes; accordingly 1.5% exceeded 3 minutes. *See* Attachment N (Survey Vehicle Stop Times).

Taking these two system specifications into account, the adjusted real world idle time is calculated as follows:

Adjusted real-world % idle time =

Real world off cycle idle time % x (1-(off button usage + max idle time)) =
21.76% x (1 – (0.01+0.015)) = 21.22%

c. Estimate the amount of GHG benefit from start-stop technology during 2-cycle testing.

EPA used its APLHA model to calculate the GHG emissions savings from a vehicle equipped with engine idle start-stop technology on the 2-cycle test. *See* Table 5-30, Joint TSD at 5-93 to 5-94. Those values were used to establish a baseline from which to calculate an off-cycle GHG benefit due to real-world idle times higher than the 10% experienced on the 2-cycle test.

[9] The ECO Button survey data are preliminary results from a broader European field study being conducted on 117 vehicles in 7 countries. Of the European survey vehicles, 42 vehicles are equipped with start-stop, including 20 smart cars. The smart cars are equipped with a different type of data logger that does not collect information on the ECO button usage. Accordingly, preliminary data from the remaining 22 start-stop vehicles are included in Attachment M.

MB conducted fuel economy tests on the FTP75 and Highway GHG certification cycles with and without start-stop. The following four test vehicles were used to cover the MB vehicle class sizes:

Vehicle Class	MB Engine Class Represented	Tested Vehicle
Small-Size Car	4-cyl.	B 250
Mid-Size Car	6-cyl.	C & E 350 4matic
Large-Size Car	8-cyl.	CLS 63 AMG
Truck	8-cyl.	ML 63 AMG

The test results of this comparison are set forth below in Table 3. For the Highway cycle, MB has utilized a conservative improvement amount of 0.0. The GHG improvement potentials with start-stop on and off are so small on the highway cycle (in most cases less than 0.5 g/mile), that test to test variations experienced in testing (as opposed to EPA's simulations) could easily exceed those potentials. Based on good engineering judgment, MB has assumed a value of 0.0 as shown below.

Table 3.

		gCO2/mi			
		Small-Size Car	**Mid-Size Car**	**Large-Size Car**	**Truck**
Driving Cycle	**Start-Stop**	(MB 4 cylinder engine)	(MB 6 cylinder engine)	(MB 8 cylinder engine)	(MB 8 cylinder engine)
FTP	On	259.8	366.9	469.4	511.4
	Off	277.6	381.6	500.0	539.1
	Improve	**17.8**	**14.7**	**30.6**	**27.7**
HWY	On	175.3	231.1	294.3	366.7
	Off				
	Improve	**0.0**	**0.0**	**0.0**	**0.0**
Combined	On	221.8	305.8	390.6	446.3
	Off	231.6	313.9	407.5	461.5
	Improve	**9.8**	**8.1**	**16.9**	**15.2**
Start-Stop Activation Effectiveness*		68.2%	67.3%	80.4%	79.4%

* Activation effectiveness calculation based on engine stop time during idle time, compared to maximum available idle time in the cycle.

These gram/mile GHG improvement values reflect the operational effectiveness of the MB start-stop system during FTP testing, including the effects of OBD on start-stop availability.[10] As demonstrated below, these values have been applied according to the MOVES availability analysis, MB specific operating parameters and real-world MB idle fraction to project real-world off-cycle GHG benefits.

d. Use the real-world engine idle fraction to scale the on-cycle benefit to real-world credit values.

EPA proportionally scaled the GHG emissions benefits due to engine idle start-stop based on the relative difference between 2-cycle idle times and real world idle times. *See* Joint TSD at 5-94. EPA then determined credit values for each vehicle class based on the difference between the 2-cycle emissions reduction and real-world emissions reductions. *See id.*

MB performed the same analytical step, but used a larger scaling factor based on its larger adjusted real-world idle fraction eligible for engine-off. A graphic depiction is provided below in Figure 1.

The on-cycle start-stop benefit is scaled up according to the eligible idle times in the test cycles, compared to the real world eligible idle times. The determined CO2 potential is then reduced by the on-cycle CO2 improvement. The following formula reflects this calculation:

$$OffCycle\ CO_2\ potential = \text{CombinedOnCycle}\ CO_2\ \text{improve} \times \frac{real\ world\ idle\ times_{eligible\ for\ start/stop}}{combined\ on\ cycle\ idle\ times_{eligible\ for\ start/stop}} - \text{CombinedOnCycle}\ CO_2\ \text{improve}$$

Based on the above formula, MB calculated the off-cycle potential for each vehicle category which is shown in Table 4:

10 [redacted]

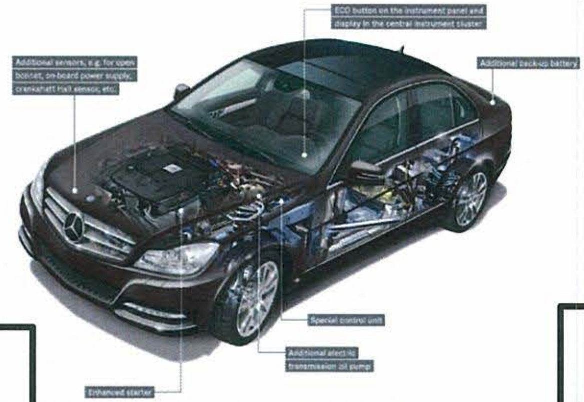
Table 4.

		FTP/HWY	Real-world	Off-cycle
	Idle Fraction eligible for Engine-Off	10.00%	21.22%	-
GHG Improvement Start-Stop, On/Off [gCO2/mi]	small size car	9.8	20.8	11.0
	mid-size car	8.1	17.2	9.1
	large size car	16.9	35.9	19.0
	full size truck	15.2	32.3	17.1

An example calculation, for the small-size car class, is provided below:

$$OffCycle\ CO_2\ potential = 9.8\ [\text{gCO2 per mile}] \times \frac{21.22\%}{10\%} - 9.8[\text{gCO2 per mile}] = 11.0\ [gCO2\ per\ mile]$$

MB vehicle with start-stop technology



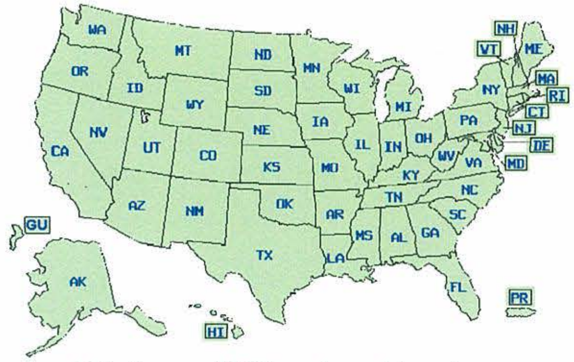
- On-Cycle system effectiveness

Off-cycle system benefit

Test Bench – FTP cycle

Idle times of FTP cycle where start-stop operates

Real world MB customer driving behavior



Idle times of MB real world customers

- On-cycle CO_2 reduction by g/mile

- Adjust real world idle time based on MB specific operating parameters
- Use FTP g/mile to calculate off-cycle CO_2 reduction

Reduce off-cycle benefit by on-cycle credits to determine off-cycle credit

e. Perform a sales weighted average across different vehicle categories to arrive at final credit values.

EPA's final pre-approved credit values were derived by taking a sales-weighted average across each vehicle class and generating a single, reliable yet conservative, credit value for all light-duty passenger vehicles and a single value for light trucks. Rather than derive only one final credit value for passenger cars, MB derived more precise credit values for each vehicle category as described in Table 4 above for small-, mid- and large-sized passenger cars. This approach is consistent with the remainder of EPA's methodology in the Joint TSD. *See* Joint TSD at 5-94 to 5-95, and Table 5-31. Of course, at the end of the model year, for reporting purposes, MB will apply the corresponding credit to each small size, mid-size, and large-size car, as well as trucks, in its U.S. fleet and thereby "sales-weight" the credits claimed.[11]

2. The MB analytical approach is robust, verifiable, and demonstrates statistically significant real-world emissions benefits over a wide range of driving conditions.

MB's alternative analytical approach meets the requirements of 40 CFR § 86.1869-12(d)(1) and should be approved by EPA. Specifically, MB's analytical approach utilized methodology that:

- is "robust, verifiable, and capable of demonstrating the real-world emissions benefit with strong statistical significance" (40 CFR § 86.1869-12(d)(1)(ii)); and

- results "in a demonstration of baseline and controlled emissions over a wide range of driving conditions and number of vehicles such that issues of data uncertainty are minimized" (40 CFR § 86.1869-12(d)(1)(iii)).

---

[11] As described in the attached projected sales tables, at Attachment O, at this point, MB does not project sales of small-size passenger cars in the U.S. with start-stop technology.

The statistical analysis provided in Attachment A demonstrates the strong statistical significance of the MB test program data for demonstrating the real world idle fraction time for MY2012 and later vehicles sold, and drove, in the U.S. The statistical analysis, and other attachments to this petition, also provide "a detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing." 40 CFR § 86.1869-12(e)(2)(iii).

3. Grouping credits by vehicle class rather than model type is an appropriate basis for the proposed off-cycle credit amount.

Pursuant to 40 CFR § 86.1869-12(d)(1)(iv), an alternative analytical approach may result in data on a basis other than the technical definition of "model type"[12] if appropriate and adequate. MB's proposed grouping, by vehicle class size (i.e., small-size, mid-size, etc.), matches EPA's approach in Chapter 5 of the Joint TSD and is likewise appropriate here. *See* Joint TSD at 5-84 to 5-95. MB's grouping of data by specific vehicle class is appropriate and adequate to provide accurate and representative idle fraction times for vehicles utilizing start-stop technology. Moreover, as demonstrated in the statistical analysis in Attachment A, MB's analytical approach by vehicle class is statistically representative of the MY2012 fleet and adequately analyzes the idle fraction time for MY2012 and later vehicles that will be sold in the U.S.

D. Application Materials Checklist

As described further below, this request and attached supporting documents addresses all of the application requirements described at 40 CFR § 86.1869-12(e)(2).

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12 "Model type" means "a unique combination of car line, basic engine, and transmission class." 40 C.F.R. § 600.002.

1. **A detailed description of the off-cycle technology and how it functions to reduce CO2 emissions under conditions not represented on the FTP and HFET.**

The requirements of this provision are met by Section III.A, III.B and III.C, and Attachments H, I and J of this request.

2. **A list of the vehicle models which will be equipped with engine-idle start stop technology.**

Attachment O (Projected Sales Data) provides a complete list of the current vehicle models equipped with start-stop technology and sold in the U.S.

3. **A detailed description of the test vehicles selected and an engineering analysis that supports the selection of those vehicles for testing.**

Section II above, and Attachment B, detail the MB test program and data collection, and the Statistical Assessment Report at Attachment A supports the statistical significance of those vehicles selected for testing.

4. **All testing and/or simulation data required under the alternate demonstration method plus any other data the manufacturer has considered in the analysis.**

Section II above, and Attachments A-G, detail the MB test program and data collection. Section III and Attachments H-O describe in detail all of the factors considered in developing MB's alternative demonstration methodology. Specifically, Section III.C describes MB's methodology step by step and summarizes all MB specific data used, including driving activity data and on-cycle data.

5. A complete description of the methodology used to estimate the off-cycle benefit of the technology and all supporting data, including vehicle testing and in-use activity data.

See Section III above in its entirety, and Attachments A-G, L (Durability Information) and N (Survey Vehicle Stop Times).

6. An estimate of the off-cycle benefit by vehicle model and the fleetwide benefit based on projected sales of vehicle models equipped with the technology.

See Section III.D.2 above and Attachment O (Projected Sales Data).

7. An engineering analysis and/or component durability testing data or whole vehicle testing data demonstrating the in-use durability of the off-cycle technology components.

See discussion above at Section III.A and Attachment L (Durability Information Presentation) summarizing MB's durability testing of start-stop technology. With durability testing more than half complete, zero failures have occurred in the more than 100 vehicles tested thus far.

IV. REQUEST FOR MY 2012-2013 EPA SPECIFIED GHG CREDITS

In addition to the start-stop GHG credits requested above, MB hereby requests GHG credits, in accordance with EPA's credit values set forth at 40 CFR § 86.1869-12(b), for the following technologies used in MY 2012-2013:

- High Efficiency Lighting (*see* § 86.1869-12(b)(1)(ii));
- Thermal Controls – Infrared Glazing (*see* § 86.1869-12(b)(1)(viii)(A)); and

- Thermal Controls – Active Seat Ventilation (*see* § 86.1869-12(b)(1)(viii)(B)).

As described in the attached supporting materials, MB's vehicles, for which these credits are requested, utilize these technologies as they are defined by the regulations and are eligible for the credits. *See* Attachment P descriptions and calculations.

High-Efficiency Lighting: EPA provides for the use of an alternative formula that can be used, on a case-by-case basis, to determine the high efficiency lighting credit amounts. *See* Joint TSD at 5-71 to 5-72. In addition to the information provided in Attachment P regarding high efficiency lighting credits, Attachment Q further details the credit amounts that should be awarded to MB for it use of high efficiency lighting that exceed the wattage efficiencies utilized by EPA in its pre-approved credit tables. MB requests these credits for all applicable models for MY 2012-2016.

Infrared Glazing: Attachment P provides details on the types of infrared glazing technologies used by MB and the credit values associated with those technologies according to EPA's pre-approved credit calculations. Attachment P also describes why 5-cyce testing is not adequate to measure such small potential credit amounts, as test-to-test variations could exceed and/or obscure the potential amounts.

Active Seat Ventilation: Attachment P provides information on how MB's active seat ventilation system works (*e.g.*, push or pull system) and confirms that active seat ventilation is included on both driver and passenger side seats in models that employ the technology, as required by the regulation. *See* Joint TSD at 5-107.

V. CONCLUSION

Based on the representative data and statistical analysis of the MB 2010-2011 test program, MB hereby requests that EPA approve the values set forth in Section III herein as the GHG credits attributable to start-stop equipped MB vehicles from MY 2012 through MY 2016. MB is currently in the process of designing a new U.S. fleet study that will include start-stop equipped vehicles. Given MB's field test principles and data collection period, and the need to provide EPA and NHTSA the opportunity to review the test design, MB expects that data from the upcoming study will not be available to support a new GHG credit request until MY 2017.

In addition, MB hereby requests that GHG credits, in the amounts provided by EPA in 40 CFR § 86.1869(b)(1) for high efficiency exterior lighting, thermal control infrared glazing and active seat ventilation technologies, as described above in Section IV and Attachment P, be available for all MY 2012 and 2013 vehicles equipped with one or more of these technologies, and in the case of high efficiency lighting, through MY 2016.

List of Attachments

Attachment A – Statistical Assessment Report

Attachment B – Test Vehicle Selection Tables

Attachment C – Owner Consent Letter

Attachment D – Instruction Manual for MicroFlea Installation

Attachment E – Car Media Sheet on MicroFlea Data Logger

Attachment F – Summary of Duration of Data Collected by Vehicle

Attachment G – List of Data Signals Collected

Attachment H – Start-Stop Function Description

Attachment I – Graphic Representation of MB Start-Stop System

Attachment J – Bosch Sheet on Electric Heater Pump

Attachment K – Excerpt from German Magazine AutoBild

Attachment L – Durability Information on MB Start-Stop Technology

Attachment M – ECO Button Survey Data

Attachment N – Survey Vehicle Stop Times

Attachment O – Projected Sales Data

Attachment P – GHG Off-Cycle Credits for Additional Technologies

Attachment Q – High-Efficiency Lighting Credit Calculations

Document in Support of Request for GHG Credits

Attachment A
Statistical Assessment Report

CONFIDENTIAL BUSINESS INFORMATION REDACTED

STATISTICAL ASSESSMENT OF IDLE TIME FRACTION CALCULATION IN MERCEDES-BENZ VEHICLES

Prepared for:

DAIMLER AG

Prepared by:

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September 3, 2013

Attachment A

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1. Background

During 2010-2011, Daimler AG, the manufacturer of Mercedes-Benz vehicles, (hereinafter "MB") conducted a study of real world driving behavior in the US as part of its commitment to product development and enhanced energy management and fuel economy for its next generation of vehicles. A total of twenty-nine (29) MY2008-2010 MB vehicles completed the data collection process to provide information on vehicle usage during normal operations, including parameters such as vehicle speed, throttle position, steering angle, AC usage, engine rpm, gear selection and engine oil and coolant temperatures. Participating vehicles were instrumented for an average of 390 days (13 months) to ensure balanced coverage of seasonal factors that influence vehicle usage and driver behavior. Data were collected over a 19-month period from January 2010 to July 2011.

In support of its application for off-cycle greenhouse gas (GHG) emissions credits for the MB Start/Stop engine control technology, MB commissioned this assessment to test the company's conclusion that the study results are representative of the operation of its US fleet. The data presented in its application to EPA for manufacturer-specific GHG credits, and referenced below, demonstrate that MB vehicles have a weighted-average idle time fraction of 23.83%. This average is higher than the idle fraction utilized by EPA in establishing the regulations at 40 CFR § 86.1869.12. A careful analysis of the MB data demonstrates that this difference is the result of the highly urbanized location and operation of MB vehicles.

This analysis considers:

- The MB study sample's distribution by geographic area and by model class;
- How the sample characteristics differ from both the sample design and from the fleet of vehicles to which the off-cycle credit will apply;
- The circumstances of increased traffic density and congestion in the urbanized areas where the sample and the MB fleet are operated; and
- Comparisons to independent information on in-use idle fraction both for the overall vehicle fleet and for MB vehicles.

Based on these considerations, we conclude that the MB 29 vehicle test fleet is representative of the MB fleet in the US and that the deviations of the sample from the State and model class distributions of the MB vehicle fleet, where they exist, do not materially affect the 23.83% idle time fraction determined in the study.

2. Sample Design

The MB test program was conducted to better understand real world driving conditions for MB vehicles operated in the US. The study design was focused primarily on customer driving behavior and its effect on energy management and in-use fuel economy. The study involved a sample of MY2008-2010 vehicles that were instrumented to collect information on vehicle operating parameters. The intent of the study was forward-looking to understand how the vehicles that MB sells in the US will be driven.

The study was planned for a sample of N=30 vehicles. According to MB personnel, this sample size was considered to be the minimum needed to provide good coverage of MB regional markets and model classes when the sample was distributed across the US. In addition, a sample size of 30 reaches the generally accepted threshold where it is considered "large" so that concerns regarding sample stability are muted. Having a *stable* sample means that another sample of the same number of vehicles should not give a materially different answer because the potential for fluctuations in sample characteristics on average has practically vanished. One vehicle failed to complete the data collection process due to technical problems. The final sample of 29 vehicles is sufficiently large to achieve all of the objectives planned for the original sample of 30 vehicles.

The study was designed as a quota sample that was stratified geographically and by model class to achieve representative coverage of MB sales in the US. The City and State locations for the study were selected to be representative of the major regional markets for MB sales, while also providing good coverage of regional differences in climate and terrain that can affect driving behavior. All MB model classes are covered except for two low-volume lines (CL and G). To make the sample more forward-looking, two recent model class introductions (GLK and Smart) were over-sampled compared to sales at that time.

Statistics for MY2008 and MY2009[1] vehicle sales by the top 100 dealerships were used to allocate the sample by State and model line. The resulting sample targets are shown in Table 1 and highlighted below:

- California is the largest US market for MB vehicle sales. Separate sample targets were developed for Southern and Northern California, and vehicles were recruited in 3 major metropolitan areas: San Diego, Los Angeles, and the San Francisco Bay areas.
- The greater New York City metropolitan area in NY, NJ, and CT is a second major regional market. A total of 3 vehicles each were allocated for recruitment in the NY and NJ portions of the metropolitan area.

[1] MY 2008 year-to-date at the time of the study's design in August 2009.

- Other major metropolitan areas were targeted in Florida, Texas, Illinois, and Virginia, which are among the top eight States for sales and offer a range of climates.
- Phoenix, AZ was chosen to include a vehicle driven in a desert climate.

The nine locations in eight States provide a diverse sample of geography (East Coast, Midwest, West Coast), climates (cold, mild, hot, wet, dry), and terrain features (mountainous western States versus plains States). These are factors that affect driving behavior through differences in trip length, seasonal road conditions, and road grades.

As shown in Table 1, the actual distribution of the sample differs to a small degree from the sample targets. The adjusted California sample is smaller than planned (12 versus 13 vehicles) because one vehicle (CLS Class) did not complete the study. The overall model line distribution for the C and E classes also differs between actual and planned to reflect the vehicles that could be recruited by the dealerships. Because the study vehicles were recruited from among the 100 top-selling dealerships in the US, the sample is targeted (by design) to the metropolitan areas where the large majority of MB vehicles are sold and operated. Appendix A provides a more detailed comparison of the sample allocation to the matrix of MB sales by State and model class.

California is over-represented in the sample (by about one-third) compared to statistics for all US sales at the time because the distribution of sales by the top 100 dealerships differs from the distribution of all US sales. Section 5 of this report shows that the increased sample weight given to California does not have a material effect on the results of the study.

Because EPA greenhouse gas standards apply to vehicles to be produced and sold in the US beginning with the 2012 model year, MB provided MY 2012 sales statistics to be used as representative of the future vehicle fleet to which the off-cycle credit would be applicable (see Table 2) . Current MB sales are concentrated in selected markets, with eight States making up more than two-thirds of total US sales. Three model classes (C, E, and SUV) account for more than 90 percent of total US sales.

Section 5 demonstrates that the sample distribution is closely representative of the distributions by State and model line that are expected for MY2012 and later vehicle sales. The section also considers the sample's representativeness with respect to urban traffic characteristics (traffic density and congestion, specifically) and shows that it is representative of where the fleet of MB vehicles is operated today.

Table 1. Test Vehicle Selection Matrix: Allocation of Sample by City/State and Model Line.

Model Line	**Southern California**	**Northern California**	**New Jersey**	**New York**	**Northern Virginia**	**Palm Beach, FL**	**Houston, TX**	**Phoenix, AZ**	**Chicago, IL**	**Target Total**	**Actual Total**
C	1	1	1	1	1		1	1	1	**8**	6
E	1		1	1		1	1			**5**	7
S						1	1			**2**	2
SL	1									**1**	1
CLK	1									**1**	1
SLK	1									**1**	1
CLS	1									**1**	0
R	1									**1**	1
M	1	1	1			1				**4**	4
GL	1					1				**2**	2
GLK										**1**	1
Smart		1		1	1					**3**	3
Target Total	**9**	**4**	**3**	**3**	**2**	**4**	**3**	**1**	**1**	**30**	
Actual Total	8	4	3	3	2	4	3	1	1		**29**

Table 2. Distribution of Mercedes Benz Sales in the US (Based on MY2012 Sales Data)

By State			By Model Class	
State	MY2012 Sales Share (%)		Class	MY2012 Sales Share (%)
Top 8 States	68.91			
CA	[redacted]		C Class	[redacted]
FL	[redacted]		E Class	[redacted]
NY	[redacted]		S Class	[redacted]
TX	[redacted]		SUV	[redacted]
NJ	[redacted]		Roadster	[redacted]
PA	[redacted]		Smart	[redacted]
MD	[redacted]		Total	100%
IL	[redacted]			
All Others	31.09			
Total	100%			

3. Vehicle Recruitment and Data Collection

As described by MB personnel, the methods used in the MB study were modeled after a 1995 field test in Europe with modifications to reflect the experience gained in that earlier study and to account for differences in the US market. Their past experience indicated that three factors were most important in obtaining high quality, representative data on driving behavior:

- Customers must be willing to participate. Recruitment through dealerships makes use of an established relationship of trust with the customer. Financial incentives were also used.
- The instrumentation of the vehicle must be "invisible" to the customer, so that the customer forgets that data are being collected.
- The period of data collection must be one year or longer to accurately characterize individual driver behavior and vehicle usage including daily business trips as well as week-end excursions and vacations.

MB has noted that the length of the data collection period may be more important than sample size in determining the representativeness of the data. The longer the duration of data collection, the more likely it is to observe a representative range of trip characteristics, including commute travel, weekend and vacation trips. Durations of one year or more are needed to assure that one observes the full range of annual travel <u>and</u> the full range of climatic and weather effects on trip characteristics.

Top-selling dealerships in each of the selected geographic locations were engaged to recruit customers willing to have their MB vehicle instrumented for the study. Field tests for gathering driving data require voluntary customer participation and the installation of instrumentation on the vehicles, which may itself affect the willingness of customers to participate. According to MB personnel, recruiting test vehicles is challenging and can face decline rates of up to 100:1 to 1000:1. Use of the dealership network to recruit customer vehicles can lead to a more favorable decline rate and, indeed, was critical to implementing the MB field study (which experienced a decline rate of less than 20:1).

For the MB field study, the recruitment methods differed in the western and eastern regions of the US. In the western region's Los Angeles Tech Center, MB contacted 2 dealers in San Francisco, 2 in Los Angeles, 1 in San Diego, and 1 in Phoenix. Being in the top 100 dealers, each dealer maintained a sufficient daily flow of customer service appointments to provide a large and varied vehicle population from which to identify customers willing to participate in the field study. In the eastern region, MB utilized a list of customers who had previously agreed to participate in CAP2000 emissions testing as potential test participants. Each of these customers was sent a letter (also used in the western region) asking if they would consider participation in the field study. Specific recruitment efforts for each region are described in greater detail below.

Western Region: Potential customer volunteers for the California and Arizona sub-samples were contacted when they brought their vehicles in for service. Dealers were given guidance on the target number and model mix of vehicles needed from their dealership, based on the Test Vehicle Selection Matrix (see Table 1). The dealers then approached potential volunteers who had vehicles matching the targets in the service department of the dealership or coming in for service. If a customer did not consent to participate in the study, the dealer approached the next customer matching the vehicle class target that presented him or herself at the dealership for service.

MB estimates that dealers approached approximately 20-30 customers per dealership, or 120-180 customers in total, during recruitment. Dealers were asked to assure that owner-offered vehicles did not appear, from maintenance records, to represent atypical driving patterns (e.g., particularly low or high annual mileage, third car driven only infrequently for recreational purposes). As customer vehicles committed to participate in the study, dealers were given updated information on the remaining number and model mix of vehicles to recruit until the targeted number of western vehicles (13) was achieved.

Eastern Region: In the eastern region, potential customer volunteers were recruited by mail. Invitation letters (in the form of the consent letter described below) were sent out to MB customers identified in the CAP2000 database, who had previously volunteered their vehicles for purposes of compliance testing. The consent letters were sent out in batches of 30-100 per mailing and 350 letters were sent out overall. MB received approximately 30 responses. Of these responses, 17 were "positive" responses in that they were willing to participate and had a vehicle meeting the necessary target mix. As in the western region, as customer vehicles committed to participate in the study, the next batch of invitation letters was then sent out to customers with vehicles meeting the remaining target mix, until the targeted number of eastern test vehicles (17) was achieved.

Once identified, either by the dealers (in the West) or through the CAP2000 database (in the East), potential customer volunteers who expressed willingness to participate in the test program were asked to execute the consent letter describing the "Parameter Measurement for Energy Management Program." (See Figure 1). Customers were told that MB "would like to collect certain driver and vehicle parameters, such as throttle position, steering angle, AC usage, rpm ranges, gear selection, engine oil and coolant temperatures during US customers normal day-to-day vehicle usage." Customers were not told that the data would be used to calculate idle time or the potential for GHG emissions reduction, but were told that the data "would only be used to determine and analyze how overall vehicle energy management can be optimized, based on US customer driver behavior." Customers were offered two payments of $500 each as a financial incentive and were indemnified against any potential damage that might be caused to the vehicle in connection with the installation and removal of the data-loggers.

Customer volunteers also were asked to complete a questionnaire to provide basic profile information (which allowed the project team to ascertain gender, age, geographic location and vehicle model information) and to self-describe individual driving behavior details (e.g., estimated annual mileage, driving style of active vs. passive driver, commuter distance, type of commuting (stop & go or flow), and time of day of commuting). See Attachment C (Customer Questionnaire).

If a potential customer volunteer consented to participate in the study by signing and returning the consent letter with questionnaire, these response forms, from both the western and eastern regions, were reviewed by a project team. In some instances, where the questionnaire responses were incomplete or where customers signed the consent letter but indicated they would be more comfortable providing the questionnaire responses over the phone, telephone interviews were conducted by project team members to obtain further information.

Potential customer volunteers and their vehicles were screened only minimally during recruitment, primarily to ensure that the vehicles met the targeted profiles for location and vehicle class, were not "third car" or recreational-only vehicles, and were close to the requested driving mileage of 10,000 miles/year. The project team monitored the gender mix and average age of the test fleet as it was recruited to assure that it tracked the typical profile of MB customers. The customer-provided information on individual driving behavior was collected to support later interpretation of the data and was not used in screening test participants. The process of screening potential test participants was an iterative one that at all times attempted to select a test fleet that was representative of the MB customers and vehicle fleet in the US (according to driver age, gender, location, and annual mileage accumulation). Once a customer vehicle was accepted into the test program, it was instrumented with the data logger by the dealer and began data collection, while recruitment of other vehicles for the program continued.

Figure 1. Consent Form for Program Participation

Parameter Measurement for Energy Management
Program Participation Consent Form

Dear **Ms. Customer**

In order to support product development and to ensure a market-driven product planning process with respect to overall energy management and fuel economy in the next generation vehicles, Mercedes-Benz would like to collect certain driver and vehicle parameters, such as throttle position, steering angle, AC usage, rpm ranges, gear selection, engine oil and coolant temperatures during U.S. customers normal day-to-day vehicle usage.

If chosen to participate in the Parameter Measurement for Energy Management Program, you will permit us to instrument your vehicle, **a 2009 GL320BT**, with an on-board data-logger system for a time period of approximately twelve months. Installation and removal of the system will be performed by Mercedes-Benz dealership technicians at no cost to you and each process will take approximately one hour. The warranty on your vehicle will not be affected in any way and Mercedes-Benz will be responsible for any damage that might be caused to the vehicle in connection with the installation and removal of the system.

The data-logger system will capture vehicle data as described above. In order to do this, the system monitors status data from the Electronic Control Units (ECUs) of the engine management system, gearbox, electrical power management as well as other units. The data is sent wirelessly to Mercedes-Benz' Energy Management back-end data server. The server will translate the ECU data to information useful for energy management and fuel economy improvement studies. All data will be stored in a database along with information collected from other program participants. Data from all vehicles will only be used to determine and analyze how overall vehicle energy management can be optimized, based on Mercedes-Benz U.S. customer driver behavior.

We will provide you with a total of $1000 to participate in this program. This payment will be issued in the form of two (2) American Express Gift cards. One (1) $500 Gift card will be issued to you after 6 months of the program completion, and the second $500 gift card will be issued to you upon the program completion and safe return of data-logging equipment. These gift cards may be used at any place where American Express is accepted.

Please note that the vehicle parameter data will be kept collectively with that of other participants in order to establish an average Mercedes-Benz U.S. customer usage profile. If you would like to participate in this program please indicate "YES" on this form, sign below and return in the envelope provided. If you do not wish to participate, please indicate "NO" on this form and return it in the enclosed envelope

I wish to participate in this program: YES NO

I understand the purpose for and processes that will be used in connection with the Program and hereby agree to participate.

____

Customer Signature

____

Date & Location

With regard to the western test vehicles, the vehicles present in a dealership's service bay on any given day amount to a customer-determined random selection of the fleet of similar vehicles that are driven in the dealership's service territory. Test participants were recruited blindly from this population except for the screening by the dealerships based on maintenance records to avoid vehicles with atypical driving (annual mileage) patterns. The methods used to recruit the western test fleet should lead to a representative sample of the vehicle fleet and their owners in the dealership's service territory, in much the same way that a formal random sample would accomplish.

With regard to the eastern test vehicles, the vehicles present in the CAP2000 database are the result of a formal random sample drawn from vehicle registration records according to the vehicle recruitment methodology in EPA's regulations. As in the western region, test participants were recruited blindly from this population except for the screening by the dealerships based on maintenance records to avoid vehicles with atypical driving patterns.

With regard to recruitment patterns, the chief pattern observed was that it was more difficult to recruit willing participants in some regional markets, particularly in comparison to California. MB has no information to indicate that recruitment was appreciably more difficult for some model lines or with respect to any other factor.

Because of the automated nature of the data collection process and the wireless transmission to MB data servers, MB believes that customers soon forgot that they were participating in a study. At no time were participants involved in recording or transmitting data. The data collection instrument was a data-logger system that automatically sampled up to 40 vehicle parameters at intervals from 0.1 Hz to 10 Hz. Among these parameters were engine rpm and vehicle speed, from which the amount of time at idle was determined. Each vehicle was instrumented for an average of 390 days (13 months) to accurately determine its individual usage profile. The 29 study vehicles were operated for 10,620 hours and accumulated over 340,000 miles during the 18-month study. As a result of the extensive amount of data and the seasonal balance, the idle time fraction for each vehicle is believed to be accurate.

4. Study Results for Idle Time Fraction

Table 3 reports the idle time fraction determined for each vehicle in the study along the vehicle description, operating hours and vehicle miles traveled during the data collection.

Table 3. Idle Fraction Data by Study Vehicle								
	City and State	Operating Hours	Hours at Idle	Idle Fraction (%)	Vehicle Miles Travelled	Days in Study	Avg Speed (mph)	Annual VMT (miles)
K22-C300	Phoenix, AZ	360.07	42.20	11.72	14,697.7	497	20	9,840
K01-ML320 BT	Redondo Beach, CA	662.00	222.96	33.68	13,384.9	552	37	11,731
K06-R350	Laguna Niguel, CA	530.04	172.48	32.54	13,606.2	141	24	7,046
K07-SL550	Newport Beach, CA	80.13	14.58	18.19	2,969.7	401	27	11,930
K08-CLK350	Newport Beach, CA	261.15	62.13	23.79	8,867.7	521	25	10,953
K13-E550	Irvine, CA	582.32	99.05	17.01	23,029.5	373	26	13,301
K16-CLS550	Newport Beach, CA	189.46	64.89	34.25	4,207.2	195	37	5,557
K20-C350	Huntington Beach, CA	267.22	60.85	22.77	7,537.9	442	34	7,325
K24-FORTWO	San Francisco, CA	80.74	17.11	21.19	1,776.5	359	37	5,944
K05-GL450	Carlsbad, CA	628.95	233.34	37.10	15,646.1	194	22	6,979
K15-GLK350	Los Gatos, CA	251.07	27.72	11.04	7,640.2	534	33	20,132
K18-C300	San Jose, CA	103.73	25.05	24.15	2,867.1	531	31	8,103
K25-ML350	Palo Alto, CA	603.23	116.60	19.33	21,221.1	440	40	19,092
K02-ML550	Boca Raton, FL	475.53	102.76	21.61	17,739.1	411	26	14,214
K04-GL320 BT	West Palm Beach, FL	491.25	100.17	20.39	13,107.8	546	30	5,108
K12-E550	Boca Raton, FL	385.26	89.00	23.10	11,793.3	408	22	3,763
K27-S600V	St. Petersburg, FL	248.82	46.63	18.74	6,177.6	383	22	11,802
K17-C300W	Roselle, IL	555.45	169.52	30.52	12,372.3	422	28	2,479
K03-ML350	Newark, NJ	114.89	28.56	24.86	2,727.0	298	26	2,574
K14-E350W4	Jersey City, NJ	626.43	168.57	26.91	16,003.8	345	28	7,977
K19-C350	Newark, NJ	81.00	20.53	25.35	2,101.4	364	22	6,810
K09-E320 BT	Smithtown, NY	157.25	23.04	14.65	5,844.7	448	41	11,985
K23-C300W4	New York, NY	504.24	128.98	25.58	13,287.1	430	26	11,291
K28-FORTWO	New York, NY	211.73	41.67	19.68	5,292.6	430	22	1,506
K11-E350W	Houston, TX	895.86	182.49	20.37	29,469.4	478	35	16,192
K21-Eclass	Houston, TX	302.54	76.97	25.44	6,795.6	292	25	7,726
K29-S550W	Houston, TX	534.92	88.32	16.51	19,209.9	166	25	11,664

K10-E350W	Mclean, VA	165.71	45.40	27.40	3,718.7	330	36	21,247
K30-FORTWO	Alexandria, VA	269.17	59.62	22.15	8,025.9	387	30	7,561
Total		10,620.16	2,531.18	23.83	311,117.5	-	-	-
Average		-	-	-	-	390	29	9,718

The weighted-average idle fraction in the sample is 23.83% based on a total of 10,620 hours of operation. This weighted-average is equal to the total hours at idle divided by the total hours of operation for the sample fleet. The average idle fraction for MB vehicles is well above both the 10.0% fraction for the FTP/HWY cycle and the 13.76% fraction determined by EPA for real-world driving.

Considering the variation in idle fraction by vehicle and the number of vehicles in the sample, the (weighted) standard error[2] in the average idle fraction is ±1.2% (one sigma) and the 95% confidence interval is ±2.4%. This uncertainty is small enough that we can be confident in concluding that the average idle fraction for MB vehicles is truly higher than EPA's estimates for in-use driving. Although the data are not derived from a formal random sample, we believe that confidence bounds computed in the usual manner give a useful indication of the precision of the result.

The average idle fraction value is based on data from eight States (CA, AZ, TX, IL, NY, NJ, VA, FL) that represent two-thirds of sales; the remaining States represent one third of MB sales. (See Table 4). With regard to the States not sampled by the Study, representing approximately one third of MB US sales, one can infer that the idle fraction cannot be much different from the idle fraction in the 8 States covered in the MB Study. This inference is supported by the Progressive Snapshot data described in detail in Section 5.3 below. Among the States not covered in the MB Study, only Pennsylvania [redacted] has greater than 3% of US sales. Pennsylvania was not chosen in the study design because its location would have been largely duplicative in terms of climate, urbanization and location in the Northeast US given that NY, NJ and VA had already been identified as targets for the Study vehicles. In place of Pennsylvania, Arizona was sampled because of its desert climate. By selecting Arizona on climate considerations, 6 additional States (MD, GA, MA, OH, CT, NC) with sales volumes higher than Arizona (but less than 3%) were bypassed. These 6 States represented from [redacted] (compared to [redacted] in Arizona)] and in every case a nearby State with similar climate was already included in the MB sample. Below Arizona in sales are 37 States and the District of Columbia with sales shares ranging [redacted] There is no State with a sales concentration greater than 3% that was not included in MB's data collection, except for Pennsylvania, and the remaining 35% of the sales

[2] The usual calculation for the unweighted variance would sum the squares of the differences between the idle fraction for each vehicle and the unweighted average for the sample. The weighted variance calculation weights each vehicle's contribution to the sum of squares in proportion to its hours of operation. This leads to a weighted standard deviation of the mean that is consistent with the weighted average idle fraction.

volume is spread over all of the other 42 States not included in the MB Study. The minor departure from MB's sales statistics resulted in improved representation of geographic and climate diversity and a stronger study.

Additionally, MB is aware of no data that would indicate the idle time of their vehicles in the remaining States is materially different than in the eight states covered in the study. Work performed for EPA during development of the MOVES model concluded that one urban area is much like another in terms of the development of the roadway system and the level of traffic density (and therefore characteristics of on-road driving) once the size of the urban area (population and areal extent) is accounted for. This prior work is used in Section 5.2 to assess the representativeness of the MB study with respect to traffic density and congestion. Given the similarity of urban areas across the country (after accounting for area size), one would not expect the idle fraction in the other states to be substantially different. As will be shown in Section 5.3, this expectation is confirmed by data collected in the Progressive Insurance Company's Snapshot program.

5. Representativeness of the Study Sample

As will be true in any study, the 29-vehicle sample differs in some respects from the distribution of the population from which it was selected. As has been shown, the sample deviates from its planned targets to only a small degree. Therefore, the question addressed in this section is whether the sample deviates in a material way from the population of MY2012 and later vehicles to which the off-cycle GHG credit would apply. That population is characterized by the distribution of MY2012 sales, the latest complete year for which sales statistics are available. As shown in the following sections, the departure of the sample from the expected mix of vehicles by State and model class has no material effect on the average idle fraction determined by the study.

5.1 Sample Distribution by State and Model Class

Table 4 presents a comparison of the sample distribution by State with the distribution that would be expected based on MY2012 sales shares. As seen in the table, the sample under-represents vehicles in New York, New Jersey, and Illinois while over-representing vehicles in California and Virginia, compared to sales statistics. When the sample is re-weighted to conform to the expected number of vehicles in each State, the average idle fraction changes to 23.59% (a decrease of 0.24%).

Table 4. Comparison of Actual versus Expected Distribution by State			
State	MY2012 Sales Share (%)	Expected Number in Sample	Actual Number in Sample
CA	[redacted]	9.1	12
NY		4.5	3
NJ		4.4	3
FL		4.4	4
TX		3.1	3
IL		1.7	1
VA		1.1	2
AZ		0.7	1
Total	66.54	29.0	29
Idle Fraction (%)	-	23.59%	23.83%

Table 5 presents a comparison of the sample distribution of vehicles by model class with the distribution that would be expected based on MY2012 sales shares. As seen in the table, the sample under-represents C-Class and SUVs, while it over-represents the S Class and Smart cars, compared to sales statistics. When the sample is re-weighted to conform to the expected number of vehicles in each model class, the average idle fraction changes to 24.33% (an increase of 0.50%).

Had the sample exactly matched the distribution of vehicles in the eight states, the average idle fraction might have been slightly lower (-0.24%). Had the sample exactly matched the distribution of vehicles by model class, the average idle fraction might have been somewhat higher (+0.50%). <u>The departure of the sample from the expected future mix of vehicles by State and model class does not have a material effect on the average idle fraction determined in the study.</u>

Table 5. Comparison of Actual versus Expected Distribution by Model Class			
State	MY2012 Sales Share (%)	Expected Number in Sample	Actual Number in Sample
C Class	[redacted]	8.7	7
E Class		7.0	7
S Class		1.4	4
SUV		10.6	7
Roadster		0.7	1
Smart		0.6	3
Total	100%	29.0	29
Idle Fraction (%)	-	24.33%	23.83%

5.2 Representativeness with Respect to Traffic Density and Congestion

It is well-known that traffic density and congestion tend to be greater in urban areas and that congestion tends to be the worst in the largest and most-densely populated urban areas. The study's higher idle fraction in comparison to EPA estimates is a direct result of where MB vehicles are operated. For this report, MB provided data on calendar year 2012 vehicle registrations by State and by County in the top eight States that account for more than two-thirds of US registrations. Among the top eight States, California accounts for [redacted] each.

To characterize the distribution of areas where MB vehicles are registered and driven, the county-level sales in the top eight States were matched to the list of Metropolitan Statistical Areas (MSAs) in the US.[3] A total of 111 different urban areas are represented in whole or in part by the urbanized counties in the eight States, along with 386 additional non-urban counties. The registration data were then merged with a database used in a 2007 study[4] for EPA that provided information on population and traffic density by MSA for the year 2000. Although the 2007 study's population and traffic density estimates are now dated, the study is nearly unique in the public record in quantifying the variation of traffic density across urban areas in the US. The 2007 study prepared inputs on trip

3 *Revised Delineations of Metropolitan Statistical Areas, Micropolitan Statistical Areas, and Combined Statistical Areas, and Guidance on Uses of the Delineations of These Areas*. Prepared by the Executive Office of the President. February 28, 2013.

4 *Development of Trip and Soak Activity Defaults for Passenger Cars and Trucks in MOVES2006*. Prepared for US Environmental Protection Agency. Prepared by Sierra Research (Sacramento, CA). Report No. SR2007-06-01 (June 2007).

characteristics that are used in the EPA MOVES mobile source emissions model today. We believe that the findings of the study remain valid and that its rankings of urban areas are still useful indicators of relative traffic density and congestion.

As Table 6 shows, almost all MB vehicles in the top eight States are registered in urban areas. Two individual urban areas – the New York-Newark-Jersey City (NY-NJ-PA) MSA and the Los Angeles-Long Beach-Anaheim (CA) MSA – with populations of more than 10 million each account for a combined 44.5% of MB registrations. Six additional urban areas with populations of at least 3 million each account for a combined 25.0% of registrations. In total, the urban areas with at least 1 million population account for the large majority (85.5%) of registrations in these States. Given the concentration of MB registrations in large urban areas, it is not surprising that MB vehicles experience an increased fraction of their operating hours at idle.

Table 6. Distribution of CY2012 Registrations by Urban Area Population [a/] (Top Eight States)

	Registration Share (%)
All Urban Areas	98.6%
> 10 million	44.5%
3-10 million	25.0%
1- 3 million	16.0%
100,000-1 million	12.2%
< 100,000	1.0%
All Non-Urban	1.4%
Total	100.0%

[a/] Based on 2000 Census.

The purpose of the 2007 study for EPA was to develop nationally representative distributions of vehicle trip times and engine-off times (between trips) for on-road vehicle categories in the EPA MOVES model. The 2007 study compiled data from the Federal Highway Administration's Highway Performance Monitoring System, from which the distribution of vehicle miles traveled (VMT) in 367 cities were characterized for 5 roadway types (interstate, non-interstate freeway, principle arterial, major arterial, minor arterial) and 7 bins covering a range of traffic density values (low to high). Using this data, Principal Components Analysis was used to determine how the VMT distribution by roadway type and traffic density bin is related to the size of the urban area.

A key finding of the study was that one urban area is much like another in terms of the development of the roadway system and the level of traffic density, once the total population of the urban area is accounted for. Figure 2 shows the primary trend in the data, in which larger cities have larger populations, extend over larger areas, have greater population densities, more VMT in total, and a greater proportion of VMT in the high traffic density bins 6 and 7 (as highlighted in the figure). There is some, but relatively little, difference in the distribution of VMT by roadway types. The nature of the relationship is logarithmic, in that traffic density increases proportionately as much when going from 100,000 to 1,000,000 population as it increases in going from 1,000,000 to 10,000,000 population. This primary trend in the data was shown to account for 87.5% of the variation in urban patterns by itself.

The 2007 study scored each of the 367 urban areas with an index measure of traffic density. The average for all urban areas in the US had an index value of zero, with a range from -1.6 for the smallest urban area to +37.2 for the largest urban area. When the 2007 study's traffic density index measure is weighted using MB registrations, we find that the MB fleet in the top eight States has an average traffic density index of 18.7 (see Table 6). This value is more than 5 standard deviations above the US average. Fundamentally, this is why the idle fraction for MB vehicles is substantially greater than the US average – the vehicles are predominantly operated in large and very large urban areas where the increased traffic density leads to greater congestion, a greater proportion of trip time at lower speeds and an increased fraction of trip time at idle

Figure 2. The Relationship of Traffic Density to Urban Area Population

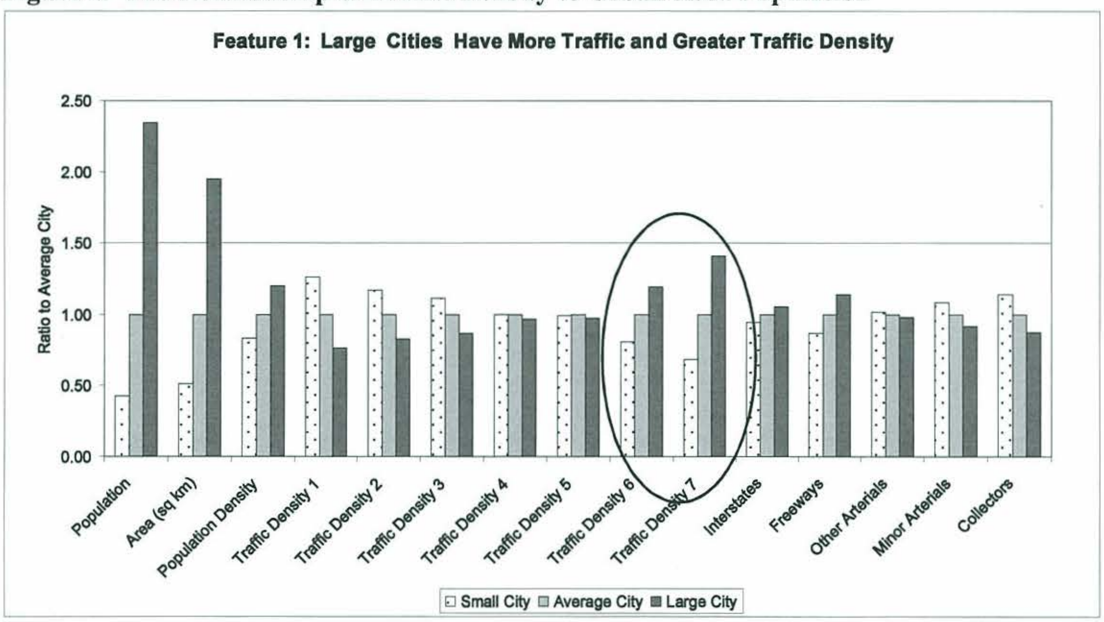
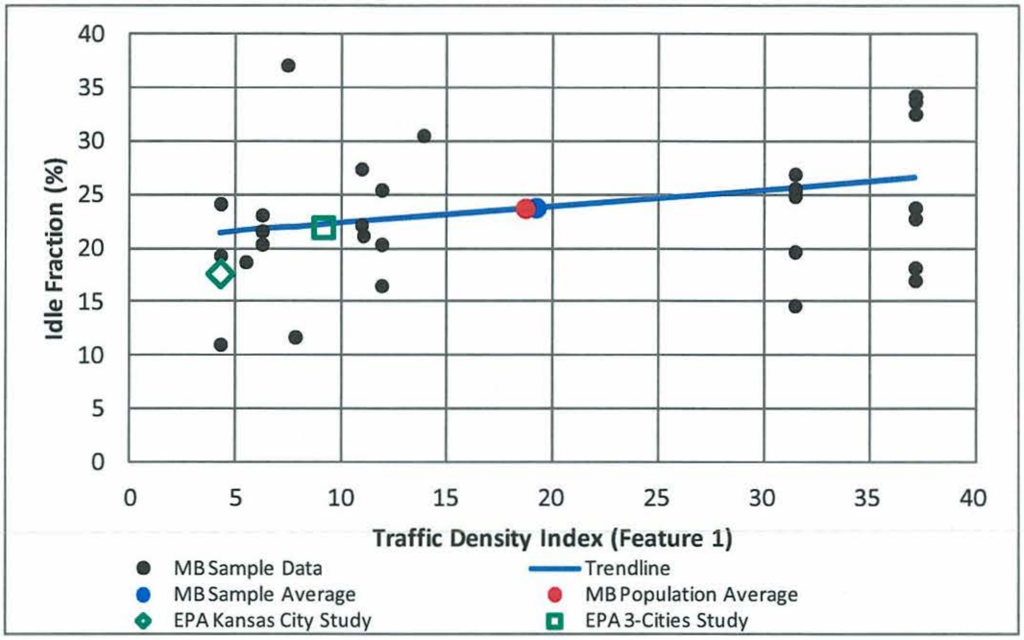


Table 7. Distribution of CY2012 Registrations by Traffic Density Index (Top Eight States)		
	Registration Share (%)	Traffic Density Index (Avg)
All Urban Areas	98.6%	
> 10 million	44.5%	34.0
3-10 million	25.0%	10.6
1- 3 million	16.0%	6.3
100,000-1 million	12.2%	-0.2
< 100,000	1.0%	-0.5
All Non-Urban	1.4%	-1.6
Total	100.0%	18.7

The 2007 study was not known to MB when the MB study was planned. The cities in which vehicles were recruited were ones generally representative of each State, but they were not selected to explicitly control for traffic density and congestion to match the average experienced by the MB fleet. To understand the implications of the city choices, we used the 2007 study for EPA to compare the traffic density and congestion faced by the 29 vehicle sample to that estimated for the MB fleet.

Figure 3 shows the relationship between the traffic density index and idle fraction for the study vehicles. The black circles are the values for the 29 study vehicles; the blue line is the trend relationship between the two variables. The trend line was estimated using regression analysis in which the data were weighted by operating hours for each vehicle so that it passes through the weighted-average idle fraction for the sample. While the idle fraction increases systematically with the traffic density index, there is also substantial scatter of the individual vehicles around the trend line caused by their individual trip characteristics.

Figure 3. Relationship between Traffic Density and Idle Fraction



The equation for the trend line is:

$$\text{Idle Fraction} = 20.88\% + 0.1538\% \cdot \text{Traffic Density Index} \qquad \text{(Eq. 1)}$$

The slope term estimates that the idle fraction increases by 0.15% for each unit increase in the traffic density index. The slope term is marginally significant in a statistical sense ($p=0.11$) because of the large scatter around the regression line. Nevertheless, the trend line can be used to estimate how the average idle fraction in the sample may be influenced by differences in traffic density between the sample and the MB population.

The sample of 29 cars faced an average traffic density index of 19.2, while the MB fleet in the top eight States faced an average traffic density index of 18.7. The sample-average idle fraction of 23.83% is the large blue circle in the figure above. Using the trend line to adjust for traffic density, we estimate that the idle fraction would be reduced to 23.75% (a change of -0.08%) at the average traffic density index for the MB fleet in the top eight States (the large red circle in the figure). Thus, we estimate that <u>the average idle fraction would change by only -0.08% if data had been collected throughout the eight States, rather than in the major metropolitan areas only</u>.

5.3 Comparison to Independent Estimates of Idle Fraction

Figure 3 above includes two additional data points (in green, taken from the Joint TSD) to add EPA estimates of real-world idle fraction from the Kansas City Study and the 3-Cities Study. The Kansas City Study (green diamond) estimated an idle fraction of 17.7% and its data point lies in the middle of the three MB vehicles sampled at a similar traffic density index. The 3-Cities Study (green square) estimated an idle fraction of 22% and its data point lies very close to trend line established by the MB data. The different estimates for the average idle fraction in the MB data and these two EPA studies appear to be explained entirely by the different traffic density levels faced in the three datasets.

Supporting information also comes from in-use data provided by the Progressive Insurance Company. The Progressive Snapshot program records vehicle speed, odometer and time of day from a cross-section of Progressive customers who voluntarily participate in the program. The data are collected for a 6 month period for each vehicle using a wireless instrument package. The average idle time of instrumented vehicles can be determined from the vehicle data collected. There are a total of about 1.4 million vehicles enrolled in the program, of which MB vehicles are expected to have a share in proportion to US registrations. The Snapshot program operates in 44 States, but has no data on vehicles from CA, NC, TN, IN, AK, and HI. Of these, only CA is a major market for MB vehicles.

The data collection method is applicable to MY 1996 and later vehicles equipped with the OBD-II system. The MY1996 data were clearly flawed (it estimated average idle times in excess of 75%) and were not used. The data for MY 1997 and later vehicles were screened to remove a small number of vehicles not identified by model class and the Sprinter van, which is not covered by the petition.

Table 8 compares the Progressive data on the average idle fraction for MB vehicles participating in the Snapshot program with the idle fractions observed in the MB study data. As can be seen in the table, the sample size is large in the Snapshot Data, both in terms of individual vehicles and total trips, and all MB passenger car and light truck classes are covered. Overall, the Snapshot data estimate that MB vehicles are at idle 23.9% of the time, in almost exact agreement with the 23.83% average estimated in the test program. Relatively little variation in the average idle fraction is seen across the model classes, with the class-specific averages ranging from 23.3% to 25.1%.

Table 8. Progressive Snapshot Data on Average Idle Fraction of MB Vehicles In Comparison to MB Data Collected in the Test Program

Class	Progressive Data				MB Study Data	
	Vehicle Count	Trip Count	Idle Fraction		Vehicle Count	Idle Fraction
C	7,678	4,072,304	23.5%		7	23.9%
E	3,520	1,956,894	23.9%		7	22.0%
G	1,028	639,852	23.6%		3	26.3%
M	2,453	1,760,417	24.2%		4	26.4%
R	395	255,368	24.7%		1	32.5%
S	2,339	1,036,753	25.1%		4	20.4%
Smart	71	15,970	23.3%		3	21.1%
Total	17,484	9,737,558	23.9%		29	23.8%

We believe that the exclusion of California from the Snapshot data leads to a conservative estimate of idle fraction (meaning the true average is higher than observed in the data) because of the greater degree of urbanization in California in comparison to the rest of the nation. These comparisons further support the conclusion that the MB study data give an accurate indication of the average idle fraction in real world driving for the MB fleet.

Finally, it should be noted that the Snapshot data cover almost all of the States that account for the one-third of MB sales that were not sampled in the MB study (in addition to seven of the eight States that were sampled).[5] A nearly complete estimate of idle fraction can be constructed by adding the idle fraction in California (excluded from the Snapshot data) to the idle fraction estimated by the Snapshot data. Combining the idle fraction estimated for CA in the MB study (26.3%, for [redacted] of sales) with the idle fraction estimated for 44 other States in the Snapshot data (23.9%, for 73.8% of sales[6]) yields an estimated, overall average idle fraction of 24.5% for 45 States that cover 96.3% of MB sales. This value is 0.7% higher than the 23.83% result of the MB study, but well within the expected precision of the result (±2.4% with 95% confidence). Thus, one can conclude that the 23.83% result of the MB study is a conservative estimate and does not over-estimate the idle fraction of all MB vehicles in the US.

5.4 Representativeness with Respect to Owner Demographics

The methods of vehicle recruitment in both western and eastern regions should lead to a representative sample of the MB vehicle fleet in the US. Neither MB nor the dealerships exercised control over the opportunity of customers to participate in the study (except through the noted screening for mileage patterns and indirectly through the choice of geographic locations where vehicles were recruited). However, it is not possible to determine from data whether the owners of the study vehicles differed demographically from the all MB owners in the US (except with regard to gender and age).

With respect to gender and age, women accounted for 30% of drivers in the study fleet compared to 39% of all MB owners. The study fleet drivers averaged 47.5 years of age, while the median age of all MB owners is 51 years. The gender and age demographics of the study fleet are close to the demographics of all MB owners.

Legal limitations on collecting and disseminating across international borders detailed demographic information beyond gender and age precluded a more detailed customer profiling effort. As a result,

[5] Specifically, Snapshot data exclude IN, NC, TN, AK, and HI, which account for only 3.7% of sales among the States not sampled in the MB US study. From the fact that the Snapshot data estimate an idle fraction nearly equal to the MB study, one can infer that the idle fraction in the States not sampled cannot be substantially different than the idle fraction in the States that were sampled.

[6] The total includes the 44.1% of sales in the States of NY, NJ, FL, TX, IL, VA, and AZ that were sampled in the study plus an additional 29.7% of sales in 37 additional States that were not sampled in the study.

other information on the demographics of study participants is not available. In spite of this, much is known about the demographics of MB owners in the US. The available information shows that MB owners have a specific and relatively narrow range of demographic characteristics that match a relatively small segment of the US population. Thus, there should be a substantial degree of similarity between the MB owners who declined to participate and the MB owners who agreed to participate in the study, which should narrow any concern regarding the potential for a non-response bias with respect to owner demographics.

For example, based on surveys in MY 2008-2010 (corresponding to the study vehicles), 61% of MB owners are male, 64% of owners are 40 through 64 years old, and 76% hold a college or graduate degree. Family income is a distinguishing feature, with 79% of MB owners reporting an annual income of $100,000 or more, compared to only 37% of all vehicle buyers nationwide. One-half of MB owners describe their occupations as executive/managerial, professional specialties, or business owner/proprietor, compared to only 28% of all vehicle buyers nationwide. From other survey information, it is known that MB vehicles are retained by their original owners longer than for other makes and it is common for older MB vehicles to be passed down to younger generations in the same family. The demographics of the original owner will tend to stay with a MB vehicle for a longer period of time and to a much greater extent than is generally true of all makes.

It is well understood that variables such as speed and acceleration are strongly affected by driver demographics. For example, young male drivers will typically have higher average speed and acceleration profiles. The same will likely be true for MB vehicles, but the available information says that there will be relatively few young males driving MB vehicles compared to other makes. Further, the idle fraction itself should be less affected by owner/driver demographics than other driving characteristics. The idle fraction should be strongly influenced by these factors:

- What type of driving is done and where (city versus highway, urban versus rural, etc.). There is clearly demographic influence on this factor through where people choose to live and the types of trips they make.
- How much traffic congestion exists, because a vehicle must conform to the traffic flow when the traffic density is high. Section 5.2 has shown that traffic density is a major influence on the idle fraction of MB vehicle. This influence is independent of owner/driver demographics.
- Ambient temperature that will influence how long vehicles are idled to warm up. This will be determined primarily by climate and also will be independent of owner/driver demographics.

With respect to owner age, we have not seen data that indicate age itself has a significant effect on idle time, certainly not in circumstances where increased traffic congestion in urban areas is a major cause for increased idle times (as is the case for MB vehicles). We believe that demographics in general will have a lesser influence on the idle fraction than for other driving characteristics.

5.5 Representativeness with Respect to Mileage

With respect to mileage accumulation rates, the variation seen among the 29 vehicle Study is an accurate reflection of the differences in vehicle mileage that occur across MB vehicle owners. In Table 3 above, data on days of participation in the Study, from Attachment F (*Summary of Duration of Data Collected by Vehicle*) of the Petition, have been used to compute an annualized VMT for each test vehicle. The average annual VMT of 9,718 miles for the 29-vehicle sample is found in the lower right hand cell of Table 3. This value is lower than values typically seen for other brands of new vehicles in the US in part because a large fraction of new MB vehicles are sold under 2- or 3-year leases with terms that provide for financial penalties if total mileage caps are exceeded at the end of the lease. To demonstrate that the VMTs of the test vehicles are typical of MB vehicles, one can compare the average mileage accumulation rate for the test vehicles to data representing the average mileage of vehicles in MB's US fleet.

A tabulation of MB vehicle mileage accumulation rates created from dealer service records is provided below in Table 9. For MY2008 – MY2013 vehicles appearing in service records two or more times during the period January 2011 through March 2013, the odometer readings (and dates) at the first and last visits were used to calculate annualized mileage accumulation rates. The averages for more than 1 million C, E, M, and S Class vehicles are set forth in Table 9 below.

Table 9. Annual Mileage Accumulation Rate for MB Vehicles (Observed January 2011-March 2013)

Model Year	Year of Ownership (Age)	Number of Vehicles	Annual Mileage Accumulation Rate (miles)
2013	1	82,547	[redacted]
2012	1-2	201,034	
2011	2-3	210,318	
2010	3-4	193,905	
2009	4-5	136,340	
2008	5-6	196,584	

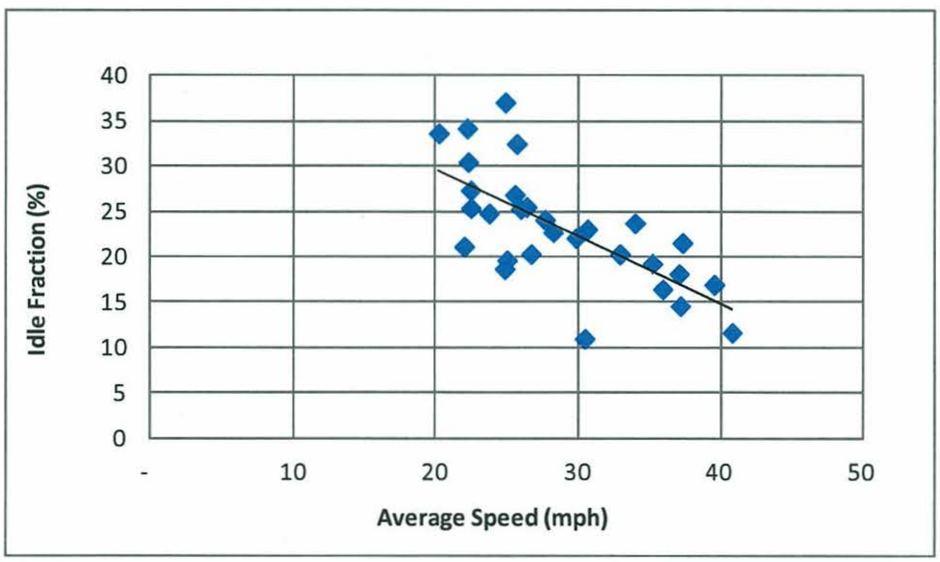
Based on age, the data for MY2012 and MY2013 vehicles are comparable to the 29 test vehicles, which were in their first or second years of ownership when the MB idle time data were collected. The annual mileage accumulation rates of [redacted] miles (MY2013) and [redacted] miles (MY2012) in Table 9 bracket the 9,718 mile average for the 29-vehicle sample, substantiating its representativeness of the MB fleet. The annual mileage accumulation rate increases as vehicles age beyond 3 years (the end of new car leases) to reach the level of 12,000 to 13,000 miles. Based on the data in Table 9, one would expect a MB vehicle to accumulate a total of 65,000 to 70,000 miles over the first 6 years of operation, a value that is similar to the US fleet overall.

To extend the service record data in Table 9 beyond 5-6 years of ownership, information from an MB warranty database was used to compute average odometers at 36, 72, and 96 months. The results confirm the estimates derived from service records and show that MB vehicles accumulate, on average: [redacted] miles at the end of 3 years (36 months), [redacted] miles at the end of 6 years (72 months) and [redacted] miles at the end of 8 years (96 months).

5.6 Speed, Mileage, and Idle Fraction Analysis

An analysis of the test vehicles' speed, mileage and idle fraction further demonstrates the consistency of the MB idle fraction data. Table 3, above, provides an average speed for each vehicle as an indicator of the mix of city and highway driving that is done. The average speed for each test vehicle was calculated using the total miles driven divided by the total hours of operation during participation in the Study. City driving will have more stops and a higher idle fraction than highway driving, a relationship that is substantiated in Figure 4 below. Average speeds of 20-25 mph over a long period of time indicate that a vehicle is driven predominantly in the city. The trendline in Figure 4 indicates an average idle fraction of 30% with a range from 20 to 35 percent for city driving. At the other end of the range, an average speed of 40 mph or more indicates a large fraction of highway driving mixed with some city driving. The trendline in Figure 4 indicates an average idle fraction of 15% for this case.

Figure 4. Relationship of Idle Fraction to Average Speed.



These results demonstrate that idle fraction is strongly related to long-term average speed as an indicator of the mix of city and highway driving. This outcome provides another check on the validity of the MB idle time data and, in conjunction with the comparisons to the Progressive Snapshot data and the mileage accumulation records for MB's US fleet (provided above), further supports the accuracy of the 23.83% idle fraction estimated from the MB data.

In conclusion, the mileage accumulation rate and spread seen in the MB Study vehicles are representative of typical MB vehicles in the first 1-2 years of ownership. As EPA is aware, a vehicle's idle fraction is a characteristic of the trips it makes and will be related, primarily, to the type of driving experienced (*i.e.*, the proportion of city versus highway trips). The increase in the mileage accumulation rate of MB vehicles after the first two years of ownership results largely from an increased number of trips, rather than a fundamental change in the type of driving that is done. Thus, the average idle fraction should not change substantially over time, even as the mileage accumulation rate increases. This is borne out by the Progressive Snapshot data, which cover MB vehicles of all ages and estimate essentially the same average idle fraction (23.9%) as the MB Study (23.83%).

6. Summary and Conclusions

The preceding discussion and analysis show that the MB real world driving study was carefully designed and obtained representative data on how MB vehicles are operated in the US. The study was conducted in a manner that would permit customers to forget about their participation in a study and simply drive in a normal way day-to-day. The study's purpose was to support product development with respect to energy management and fuel economy. The time each vehicle spent at idle was among the parameters that can be determined from the data. An extensive record of driving behavior was obtained for each vehicle and was used in the determination of its idle time fraction.

The methods of sample allocation and vehicle recruitment were designed to give representative coverage of the regional markets where MB vehicles are operated and of the national distribution of the fleet by model class. The sample allocation closely met its targets for MY2008-2010 vehicles. When the sample is compared to MY2012 sales, used as representative of the vehicle fleet to which GHG emission standards apply, modest deviations are observed by geographic location and by model class. The analysis presented in this report was designed to determine whether these deviations have a material impact on the average idle time fraction determined in the study.

When the sample is compared to the distribution of MY2012 sales, we find:

- The sample deviations with respect to the State distribution have no material impact. The average idle fraction <u>decreases by 0.24%</u> when the sample distribution is controlled to match the distribution of sales.

- The sample deviations with respect to the model class distribution have no material impact. The average idle fraction increases by 0.50% when the sample distribution is controlled to match the national distribution of sales.
- The sample, which was recruited in large urban areas where the participating dealerships were located, faced a slightly higher traffic density index than did the overall fleet of MB vehicles in the top eight States. The average idle fraction decreases by 0.08% when the sample is adjusted to reflect the traffic density faced by the overall fleet.

The average idle fraction of 23.83% can be compared to independent sources of information on the idle fraction of vehicles. The EPA Kansas City and 3-Cities Studies report average idle fractions for the on-road fleet (all makes) that are consistent with the result of the MB study once the traffic densities in the study cities are accounted for. The Progressive Snapshot program reports an average idle fraction for its insured fleet of MB vehicles (MY1997 and later) that is in almost exact agreement with the result of the MB study.

The MY2012 sales data are used here as representative of the fleet of MY2012 and later vehicles that will be sold in the US. The actual distribution of future fleet sales is not known and the comparisons presented here cannot be exact. The average idle fraction for the future fleet might be somewhat higher or lower than the 23.83% value measured in the MB study, but any such difference should be well within the range of statistical uncertainty in the data (±2.4% with 95% confidence). Based on the assessment documented here, we conclude that the vehicle sample in the MB study is representative of the MB fleet in the US. We recommend that the 23.83% value determined in the study be accepted as representing the average idle time fraction of MB vehicles in the US.

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Appendix A: Sales Volumes by State and Model Class

The following table provides information requested by EPA on the distribution of MB sales by model class in the eight States where the MB study was conducted. These data reflect final MY sales and will differ from the sales information available to the MB team members when the study was designed (during MY 2009).

Table A-1: MY 2008-2009 Sales Volumes by State and Model Class

	CA	NJ	NY	VA	FL	TX	AZ	IL
C-Class	33,945	12,023	11,438	3,657	14,437	11,241	1,922	3,961
CL-Class	1,811	541	468	107	761	411	92	224
CLK-Class	7,399	2,519	2,244	510	3,213	1,263	421	431
CLS-Class	3,189	813	785	285	1,338	920	189	244
E-Class	20,440	8,867	8,579	1,809	6,455	3,984	964	1,824
G-Class	470	175	183	42	228	128	37	74
GL-Class	7,919	4,781	4,216	1,087	4,836	3,546	743	1,663
M-Class	11,656	9,086	7,190	1,432	6,102	4,168	906	2,212
R-Class	2,556	2,014	1,790	285	1,211	702	158	364
S-Class	8,327	4,380	4,325	657	3,823	2,344	481	1,489
SL-Class	3,018	918	1,002	203	1,521	906	280	348
SLK-Class	2,134	635	513	234	1,014	765	208	142
SLR-Class	66	22	18	2	23	11	3	8
Smart	1	1	-	-	-	-	-	2
Total	102,931	46,775	42,751	10,310	44,962	30,389	6,404	12,986

The sales data are used to compute the expected allocation of the 30-vehicle sample by State and model line, shown in the following table. Shaded cells in the table indicate the State / model class combinations that were not sampled in the study. In allocating the sample, a decision was made not to cover two low-volume model classes (CL and G). Further, two new model class introductions (GLK and Smart) were over-sampled compared to sales at that time. As the table demonstrates, the sample selection by State and model class conforms closely to the distribution of sales. Note that the allocation of the sample geographically was based on the distribution of sales by the top 100 dealerships, which differs from the distribution of all US sales shown in the table. Section 5.1 of this report compares the sample distribution by State and model line to data on MY 2012 sales and shows that deviations of the sample from current sales do not materially impact the average idle fraction estimated in the study.

Table A-2: Expected Allocation of Sample by City/State and Model Line Based on MY 2008-2009 Sales Volumes

Model Line	CA	NJ	NY	VA	FL	TX	AZ	IL	Expected Total	Actual Total
C	3.4	1.2	1.2	0.4	1.5	1.1	0.2	0.4	9.3	6
E	2.1	0.9	0.9	0.2	0.7	0.4	0.1	0.2	5.3	7
S	0.8	0.4	0.4	0.1	0.4	0.2	0.0	0.2	2.6	2
CL	0.2	0.1	0.0	0.0	0.1	0.0	0.0	0.0	0.4	
SL	0.3	0.1	0.1	0.0	0.2	0.1	0.0	0.0	0.8	1
CLK	0.7	0.3	0.2	0.1	0.3	0.1	0.0	0.0	1.8	1
SLK	0.2	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.6	1
CLS	0.3	0.1	0.1	0.0	0.1	0.1	0.0	0.0	0.5	0
R	0.3	0.2	0.2	0.0	0.1	0.1	0.0	0.0	0.9	1
M	1.2	0.9	0.7	0.1	0.6	0.4	0.1	0.2	4.3	4
G	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.1	
GL	0.8	0.5	0.4	0.1	0.5	0.4	0.1	0.2	2.9	2
GLK[a/]	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	0.0	1
Smart	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3
Expected Total	10.1	4.7	4.3	1.0	4.5	3.1	0.6	1.3	30	
Actual Total	12	3	3	2	4	3	1	1		29

[a/] GLK sales data are not available at this time.

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Document in Support of Request for GHG Credits

Attachment B
Test Vehicle Selection Tables

Test Vehicles

Vehicle	Customer #	Model	State
K22-C300	22	C300	AZ
K01-ML320 BT	**1**	**ML320 BT**	**CA**
K05-GL450	5	GL450	CA
K06-R350	6	R350	CA
K07-SL550	7	SL550	CA
K08-CLK350	8	CLK350	CA
K13-E550	13	E550	CA
K15-GLK350	15	GLK350	CA
K16-CLS550	16	CLS550	CA
K18-C300	18	C300	CA
K20-C350	20	C350	CA
K24-FORTWO	24	FORTWO	CA
K25-ML350	25	ML350	CA
K02-ML550	2	ML550	FL
K04-GL320 BT	**4**	**GL320 BT**	**FL**
K12-E550	12	E550	FL
K27-S600V	27	S600V	FL
K17-C300W	17	C300W	IL
K03-ML350	3	ML350	NJ
K14-E350W4	14	E350W4	NJ
K19-C350	19	C350	NJ
K09-E320 BT	**9**	**E320 BT**	**NY**
K23-C300W4	23	C300W4	NY
K28-FORTWO	28	FORTWO	NY
K11-E350W	11	E350W	TX
K21-Eclass	21	C350W	TX
K29-S550W	29	S550W	TX
K10-E350W	10	E350W	VA
K30-FORTWO	30	FORTWO	VA

Notes			
Original vehicle	30 (30)	FORTWO	TX
Replacement vehicle	31 (21)	E350W	TX

Blue = Diesel

Attachment B - Test Vehicle Selection Tables (Test Vehicles)

US customer driver behaviour data collection project, Aug 2009: Vehicle model selection and location for data collection

	Southern California	Northern California	New Jersey	New York	Virginia	Palm Beach, FL	Houston, TX	Phoenix, AZ	Chicago, IL	Target Total
C	1	1	1	1	1		1	1	1	8
E	1		1	1		1	1			5
S						1	1			2
SL	1									1
CLK	1									1
SLK	1									1
CLS	1									1
R	1									1
M	1	1	1			1				4
GL	1					1				2
GLK		1								1
Smart		1		1	1					3
Target Total	9	4	3	3	2	4	3	1	1	**30**

Matrix based on car line sales percentages 2008 and 2009 YTD, and locations of top selling 100 dealerships 2008.

Attachment B - Test Vehicle Selection Tables (Target Matrix)

TEST VEHICLE FLEET - Car Line Selection Table

Model	08+ YTD 09	%	Number Test vehicles					Regions, 08			
C-CLASS	85,025	0.27	8.144781	8	C-CLASS	5 C300		CA	13	Socal	9
						3 C350				Bay	4
E-CLASS	50,710	0.16	4.857652	5	E-CLASS	3 E350					
						2 E550		East Coast	12	NJ	3
S-CLASS	19,621	0.06	1.87955	2	S-CLASS	1 S550				NY	3
						1 S600				VA	2
CL-CLASS	2,902	0.01	0.277991	0	CL-CLASS					Palm Beach	4
SL-CLASS	7,130	0.02	0.683003	1	SL-CLASS	SL550		South / Central	5	Houston	3
										Phoenix	1
CLK-CLASS	13,696	0.04	1.311978	1	CLK-CLASS	CLK350				Illinois/ Hoffman Est.	1
SLK-CLASS	5,939	0.02	0.568913	1	SLK-CLASS	SLK300					
CLS-CLASS	6,425	0.02	0.615469	1	CLS-CLASS	CLS550					
R-CLASS	8,070	0.03	0.773048	1	R-CLASS	R350					
M-CLASS	37,372	0.12	3.579968	4	M-CLASS	2 ML350					
						1 ML550					
						1 ML BT	Diesel				
G-CLASS	1,005	0.00	0.096272	0	G-CLASS						
GL-CLASS	24,595	0.08	2.356023	2	GL-CLASS	1 GL550					
						1 GL BT	Diesel				
GLK-CLASS	14,457	0.05	1.384876	1	GLK-CLASS	1 GL350					
Smart	*36,229*	*0.12*	*3.47048*	*3*	*Smart*	*3 ForTwo*					
TOTAL	**313,176**	1	26.52952	30					30		30

ML and GL diesel vehicles are appr 22% of sold ML/GL.
E-class (BR211) appr 13% diesel.

Attachment B - Test Vehicle Selection Tables (Car Line Selection)

Document in Support of Request for GHG Credits

Attachment C
Owner Consent Letter

Parameter Measurement for Energy Management
Program Participation Consent Form

[Date]

Dear **Ms. Customer**

In order to support product development and to ensure a market-driven product planning process with respect to overall energy management and fuel economy in the next generation vehicles, Mercedes-Benz would like to collect certain driver and vehicle parameters, such as throttle position, steering angle, AC usage, rpm ranges, gear selection, engine oil and coolant temperatures during U.S. customers normal day-to-day vehicle usage.

If chosen to participate in the Parameter Measurement for Energy Management Program, you will permit us to instrument your vehicle, **a 2009 GL320BT**, with an on-board data-logger system for a time period of approximately twelve months. Installation and removal of the system will be performed by Mercedes-Benz dealership technicians at no cost to you and each process will take approximately one hour. The warranty on your vehicle will not be affected in any way and Mercedes-Benz will be responsible for any damage that might be caused to the vehicle in connection with the installation and removal of the system.

The data-logger system will capture vehicle data as described above. In order to do this, the system monitors status data from the Electronic Control Units (ECUs) of the engine management system, gearbox, electrical power management as well as other units. The data is sent wirelessly to Mercedes-Benz' Energy Management back-end data server. The server will translate the ECU data to information useful for energy management and fuel economy improvement studies. All data will be stored in a database along with information collected from other program participants. Data from all vehicles will only be used to determine and analyze how overall vehicle energy management can be optimized, based on Mercedes-Benz U.S. customer driver behavior.

We will provide you with a total of $1000 to participate in this program. This payment will be issued in the form of two (2) American Express Gift cards. One (1) $500 Gift card will be issued to you after 6 months of the program completion, and the second $500 gift card will be issued to you upon the program completion and safe return of data-logging equipment. These gift cards may be used at any place where American Express is accepted.

Please note that the vehicle parameter data will be kept collectively with that of other participants in order to establish an average Mercedes-Benz U.S. customer usage profile. If you would like to participate in this program please indicate "YES" on this form, sign below and return in the envelope provided. If you do not wish to participate, please indicate "NO" on this form and return it in the enclosed envelope

I wish to participate in this program: YES NO

I understand the purpose for and processes that will be used in connection with the Program and hereby agree to participate.

____

Customer Signature

____

Date & Location

Attachment C

Mercedes-Benz
Research & Development North America,

Ann Arbor Technology Center

Parameter Measurement for Energy Management Program
Customer Participant Information Request

Customer Information

First Name ______ Last Name ______ Middle Initial ______ Birth date (MM/DD/YYYY) ______

Address ______ City ______ State ______ ZIP ______

Home Phone ______ Work Phone ______ Cell Phone ______

Email Address ______ Fax Number ______

Vehicle Information

Model Year ______ Model ______ Purchase Location ______ Purchase Date ______

Current Mileage ______ Own/Lease ______ Approximate Miles/Year ______ Service/Repair Dealership ______

If you lease your vehicle, will you have this vehicle for the next 13 months?______

Driving Style

1. On a scale from 1 to 4, 1 being relaxed/mild and 4 being aggressive and hard-driving, please rate your average driving style:

Mild 1 2 3 4 Aggressive

2. Would you classify yourself as more of a **Type A** or **Type B** driver?______
(**type A** is competitive, hard-driving, time-conscious, and aggressive; **type B** is the opposite: relaxed, unhurried, satisfied, and serene)

Average commute description ______

______

Average commute length/time:______

Traffic (stop and go / smooth traffic flow)**:**______

What time of the day do you do most of your driving?______

Attachment C

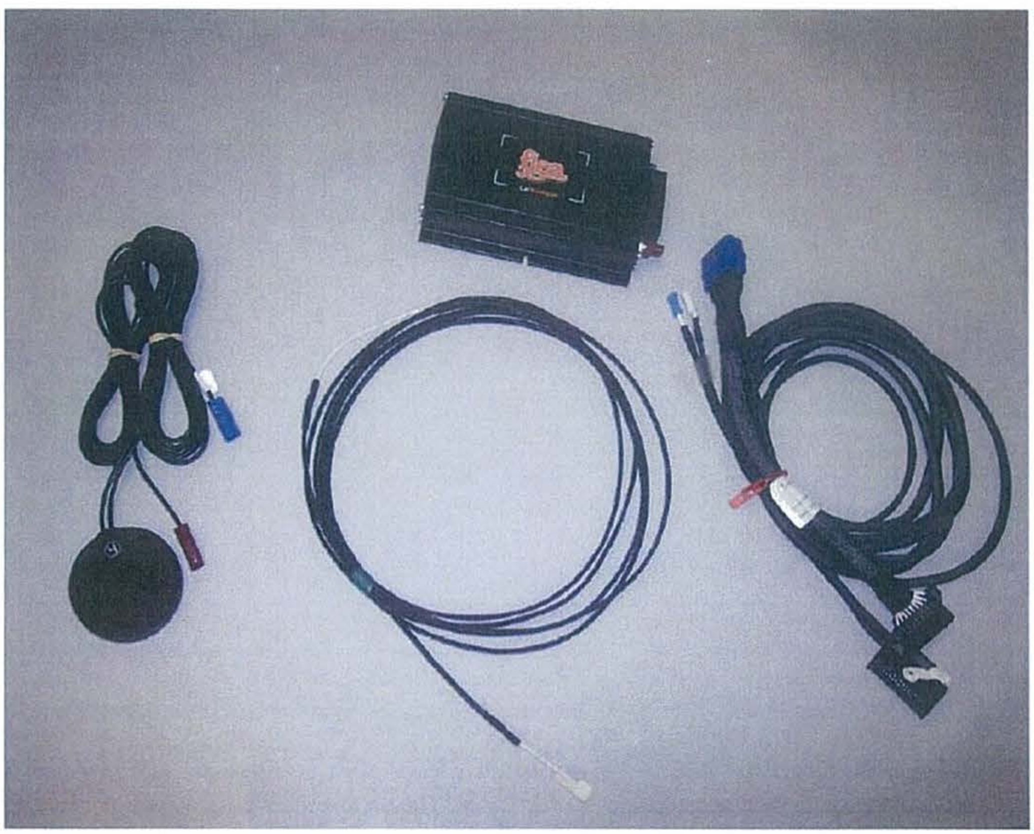
Document in Support of Request for GHG Credits

Attachment D
Instruction Manual for MicroFlea Installation

Mercedes-Benz

Instruction manual for installation of the FLEA BOX

Vehicle type W204 / X204 (C class / GLK class)



Kit includes:

(1) FLEA BOX.
(1) OBD/CAN HARNESS.
(1) GPS antenna harness and GPS puck.

Connection points to be made in vehicle:

- OBDII (splitter harness provided)

- KL15 power (connect at front SAM)
- GROUND

- CHASSIS CAN (driver side under carpet)
- DRIVETRAIN CAN marked PT-CAN (passenger side under carpet)

Kit placement:

- FLEA logger is secured to Module Bracket under passenger side carpet

- GPS puck/antenna is mounted at lower right corner of windshield

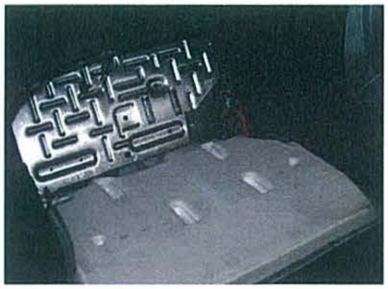
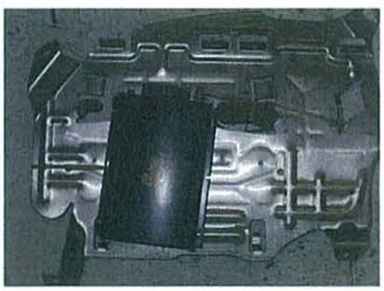
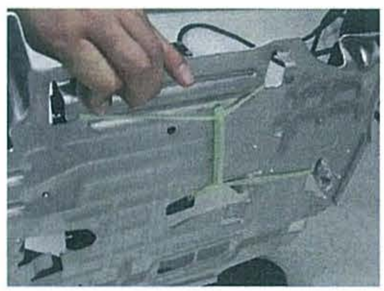
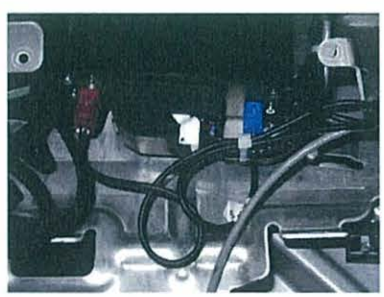
Installation:

1. Installing data logger box, OBDII and CAN wiring harness & antenna
2. Connecting terminal 15 cable to fuse box

Make sure that the ignition is OFF during the entire time of installation!
Release the panel under the steering wheel. You do not have to remove it completely. The space behind must just be accessible.

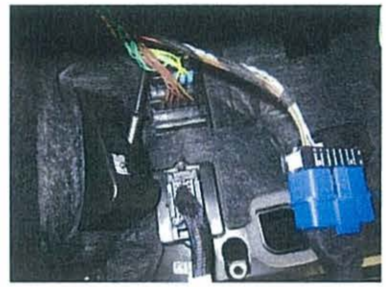
It is important to keep in mind that the installation of the unit should have no impact on the functionality of the safety belts or the driver's foot compartment.

1. Installing data logger box, OBDII, CAN wiring harness&antenna

		
(1) Remove floor carpet on passenger side	**(2)** Open the footrest by using a power screwdriver	**(3)** Open footrest panel
		
(4) Attach FLEA box to the back of footrest panel by using cable ties, add some foam padding/ felt between box and plate to prevent rattle.	**(5)** Tighten cable ties and cut off long ends of ties.	**(6)** Fasten the antenna to the lower right corner of the windshield and route the cable behind the trim panels, along right side of dash to FLEA Box, securing all cables.
		
(7) Connect the antenna wires (red and blue) to the Flea box. **MAKE SURE these connectors lock in correctly and don't pull out!**	**(8)** Also connect the main FLEA connector. Lock it correctly with the locking lever.	**(9)** Mount ground wire to near by grounding point of the chassis. Secure all loose cables.

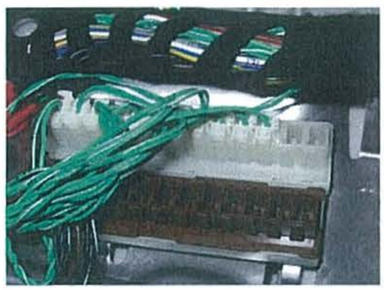
(10) Open the knee-panel on driver side.

(11) Route the OBDII, Chassis CAN and KL15 wire behind the heater case/ Firewall to the driver side. (S-class shown in photo for illustration purpose only)

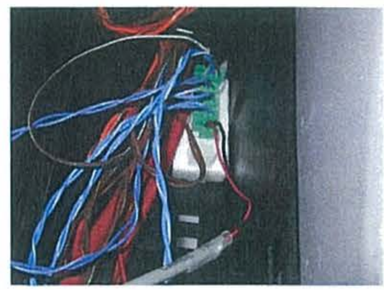


(12) Connect the OBDII wiring harness to vehicle OBD cable connector from OBD socket. Secure with cable ties!

(13) Fold up carpet to access CAN connector



(14) Chassis CAN (green white cables) driver side under carpet. Plug in CAN-Pin of harness into empty port of Chassis CAN.



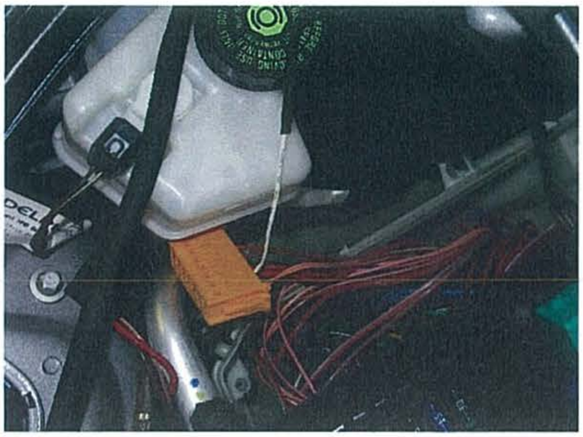
(15) PT-Sensor CAN (blue / blue white cables) passenger side under carpet. Plug in PT-Pin of harness into empty Port of PT CAN.

(16) Position the cables so that they are out of the way when closing the footrest.

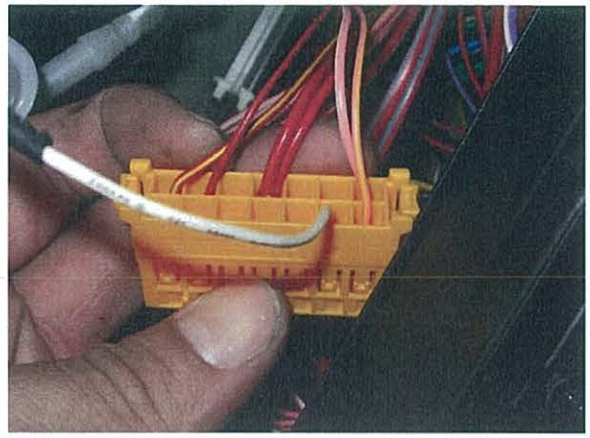
(17) close footrest.

...continue with next step.

2. Connecting Terminal 15 extension cable to fusebox in engine compartment

<table>
<tr>
<td>

(1) Remove N10/1 front SAM. Unplug connector C11 from the bottom of the fusebox (yellowish orange).

Route terminal 15 extension cable into the engine compartment through firewall.</td>
<td>

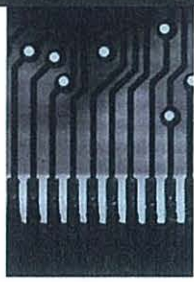
(2) Insert the Kl. 15 circuit pin to the front SAM N10/1 on connector 11C (yellowish orange color). Pin 11 should be an empty port.

(IF NOT PLEASE CALL MR. JOHN ESPELETA FOR ASSISTANCE).</td>
</tr>
<tr>
<td colspan="2">**(3)** Plug the connector back into C11 port.
Insert the fusebox back into engine compartment.
Make sure that fuse # F5 has an 7.5 amp fuse inserted.
Close the fusebox.</td>
</tr>
</table>

Document in Support of Request for GHG Credits

Attachment E
Car Media Sheet on MicroFlea Data Logger

CarMedialab


micro flea

Basic Telematics Unit

Low Cost Approach
The MicroFlea is a telematics unit reduced to its minimal feasible functionality. This minimizes costs dramatically and allows pricing models which have been unrealistic for a long time.

Communication Gateway
Primary requirement is to establish communication paths between the bus system inside the vehicle, the user and the back-end. The vehicle is now accessible for many different purposes.

Car Integrated Services
Added value is generated by utilizing an in-vehicle telematics unit and vehicle specific applications – the Car Integrated Services. The MicroFlea is designed for effortless support of services such as fleet management, remote diagnostics, and eCall or other GPS based services. This provides a system that can be used as an Off-the-Shelf-Product for fleet management while providing the basis of future development appropriate to vehicle manufacturers' needs.

Hardware	The MicroFlea
Processor	16bit microprocessor
Main memory	64 KB SDRAM
Flash memory	1 MB Flash
UMTS	UMTS/HSDPA Dual (850/1900), GPRS/EDGE Quad
GPS	50 channels
Interfaces (external)	1 x RS232
	3 x CAN
Input voltage	6 V to 18 V
Operating temperature	-40 - +85 °C
Dimensions	150 mm x 100 mm x 30 mm
Weight	150 g
Services	Vehicle State/Fleet Monitoring
	Telediagnostics
	eCall/bCall
	Stolen Vehicle Tracking
	ECU Communication Server

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D-76646 Bruchsal
Germany

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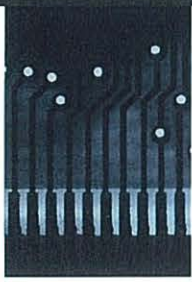
Fax: +49 7251 38 62 51
info@carmedialab.com

More informationen about
The Flea, The MicroFlea
and CarMedialab:

www.CarMedialab.com

CarMedialab


micro flea

Basic Telematics Unit

Technical Specifications

(Rev 2.0)

General Specifications

- **Power Supply:**
  - 6 V to 18 V
- **Interfaces:**
  - Digital I/Os
  - 3 x CAN
  - RS232
  - I^2C
  - GSM antenna connector
  - GPS antenna connector
- **Approvals**
  - n/a
- **Power Consumption – typical@12V:**
  - Off/Run: 0/56 mA
  - Sleep (RTC only): < 500 µA
  - Sleep (RTC and UMTS): < 2,5 mA
- **Temperature Range:**
  - Operating: -40 - +85 °C

Firmware Specifications

- 16 bit Dualcore Freescale MC9S12XEP100, max. 100MHz
- FreeRTOS, OSEK, no OS

Memory (min/max)

- Flash (KB): 1024
- RAM (KB): 64

Development Kit

- Cosmic Compiler V4.8.16
- BDM Interface

GSM/GPRS Specifications

- UMTS/HSDPA Dualband (850/1900 MHz)
- GPRS/EDGE Quadband (850/900/1800/1900 MHz)
- Output Power Class: 4(850/900), 1(1800/1900)
- UMTS Terrestrial Radio Access (UTRA), Freq. Division Duplex (FDD)
- WCDMA/HSDPA/HSUPA Power Class 3
- SMS (MO/MT)

GPS Specifications

- uBlox 6 positioning engine
- Assisted GPS
- Receiver L1, C/A Code, 50 channels
- SBAS, WAAS, EGNOS, MSAS, GAGAN
- Position accuracy (SBAS/autonomous) < 2 m / < 2,5 m
- TTFF (hot/warm/cold) < 1 s / < 29 s / < 29 s

Mechanical Specifications

- Dimension: 15 cm x 10 cm x 3 cm
- Weight: 150 g
- Connectors: ÄMP

Wakeup Options

- On Ignition
- On CAN
- On Modem Ring / SMS

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More informationen about The Flea, The MicroFlea and CarMedialab:

www.CarMedialab.com

Document in Support of Request for GHG Credits

Attachment F
Summary of Duration of Data Collected by Vehicle

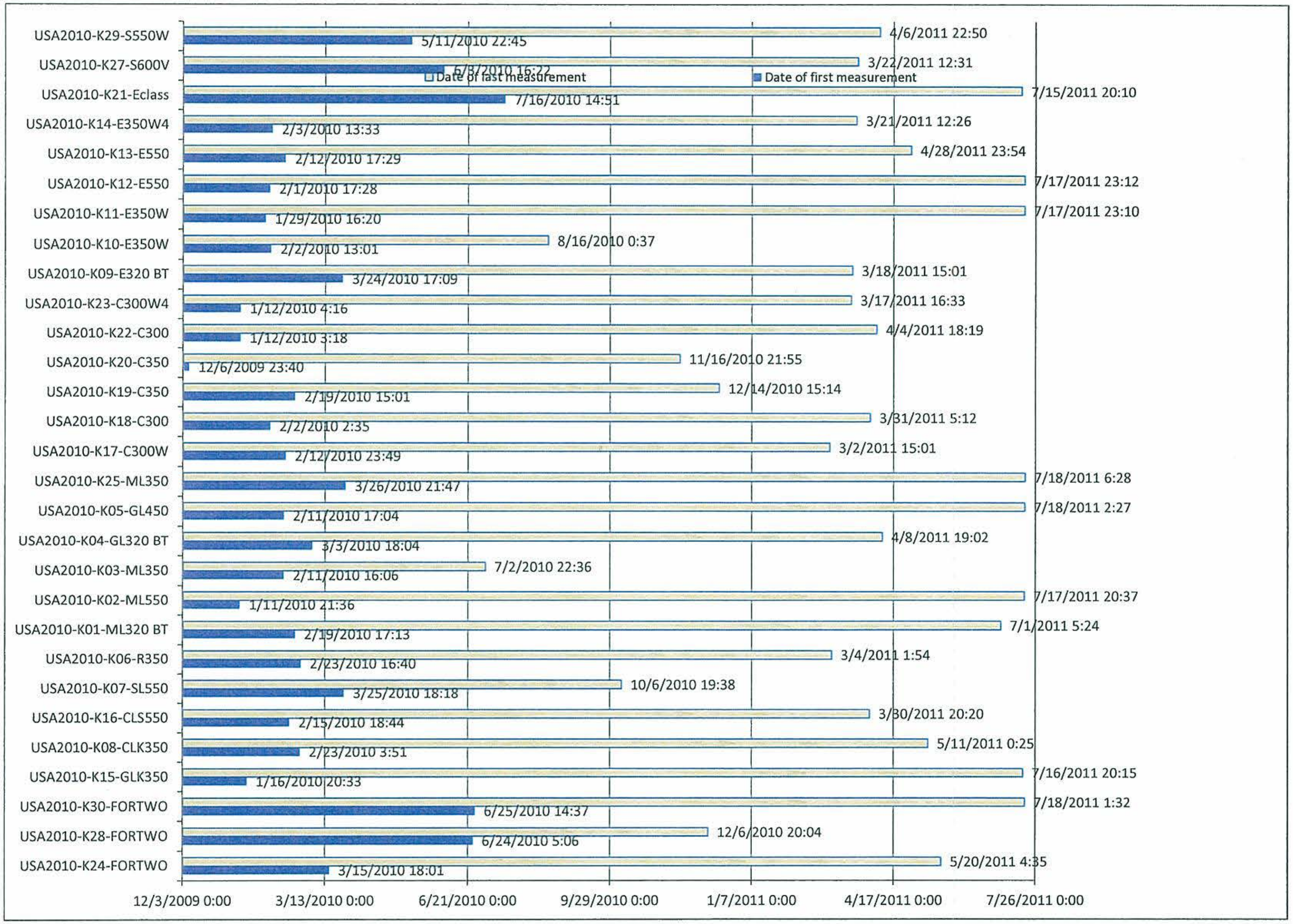
Duration of Data Collection by Vehicle

Vehicle name	Date of first measurement	Date of last measurement	Measurement days
USA2010-K24-FORTWO	3/15/2010 18:01	5/20/2011 4:35	430
USA2010-K28-FORTWO	6/24/2010 5:06	12/6/2010 20:04	166
USA2010-K30-FORTWO	6/25/2010 14:37	7/18/2011 1:32	387
USA2010-K15-GLK350	1/16/2010 20:33	7/16/2011 20:15	546
USA2010-K08-CLK350	2/23/2010 3:51	5/11/2011 0:25	442
USA2010-K16-CLS550	2/15/2010 18:44	3/30/2011 20:20	408
USA2010-K07-SL550	3/25/2010 18:18	10/6/2010 19:38	195
USA2010-K06-R350	2/23/2010 16:40	3/4/2011 1:54	373
USA2010-K01-ML320 BT	2/19/2010 17:13	7/1/2011 5:24	497
USA2010-K02-ML550	1/11/2010 21:36	7/17/2011 20:37	552
USA2010-K03-ML350	2/11/2010 16:06	7/2/2010 22:36	141
USA2010-K04-GL320 BT	3/3/2010 18:04	4/8/2011 19:02	401
USA2010-K05-GL450	2/11/2010 17:04	7/18/2011 2:27	521
USA2010-K25-ML350	3/26/2010 21:47	7/18/2011 6:28	478
USA2010-K17-C300W	2/12/2010 23:49	3/2/2011 15:01	383
USA2010-K18-C300	2/2/2010 2:35	3/31/2011 5:12	422
USA2010-K19-C350	2/19/2010 15:01	12/14/2010 15:14	298
USA2010-K20-C350	12/6/2009 23:40	11/16/2010 21:55	345
USA2010-K22-C300	1/12/2010 3:18	4/4/2011 18:19	448
USA2010-K23-C300W4	1/12/2010 4:16	3/17/2011 16:33	430
USA2010-K09-E320 BT	3/24/2010 17:09	3/18/2011 15:01	359
USA2010-K10-E350W	2/2/2010 13:01	8/16/2010 0:37	194
USA2010-K11-E350W	1/29/2010 16:20	7/17/2011 23:10	534
USA2010-K12-E550	2/1/2010 17:28	7/17/2011 23:12	531
USA2010-K13-E550	2/12/2010 17:29	4/28/2011 23:54	440
USA2010-K14-E350W4	2/3/2010 13:33	3/21/2011 12:26	411
USA2010-K21-Eclass	7/16/2010 14:51	7/15/2011 20:10	364
USA2010-K27-S600V	6/3/2010 16:22	3/22/2011 12:31	292
USA2010-K29-S550W	5/11/2010 22:45	4/6/2011 22:50	330

Diesel

Under 365 days

Measurement Period [days] 390.3



Attachment F

Document in Support of Request for GHG Credits

Attachment G
List of Data Signals Collected

CONFIDENTIAL BUSINESS INFORMATION REDACTED

Signals Collected

Signal name	Sample Rate [ms]	Sample rate [Hz]
[redacted]		

Document in Support of Request for GHG Credits

Attachment H
Start-Stop Function Description

CONFIDENTIAL BUSINESS INFORMATION REDACTED

Mercedes-Benz Passenger Cars ECO Start-Stop Function Description

Confidential

Content

1 General Information

The Mercedes-Benz ECO start-stop function is designed to maximize the engine off status when a vehicle is not in motion. The system is also designed to maintain vehicle occupant safety features and other vehicle functions during the engine off status.

Following is a detailed description of the primary operating parameters for the Mercedes-Benz ECO start-stop system and how the system operates in conjunction with other vehicle emission, safety, and convenience systems.

2 Operating Strategy

2.1 Automatic Stop

For the automatic stop function to cut off engine power, all of the following conditions must be met:

- vehicle system coordination conditions are fulfilled – see Section 3 below
- brake pedal is pressed
- car stands still
- shift lever is in position 'D' or 'N'

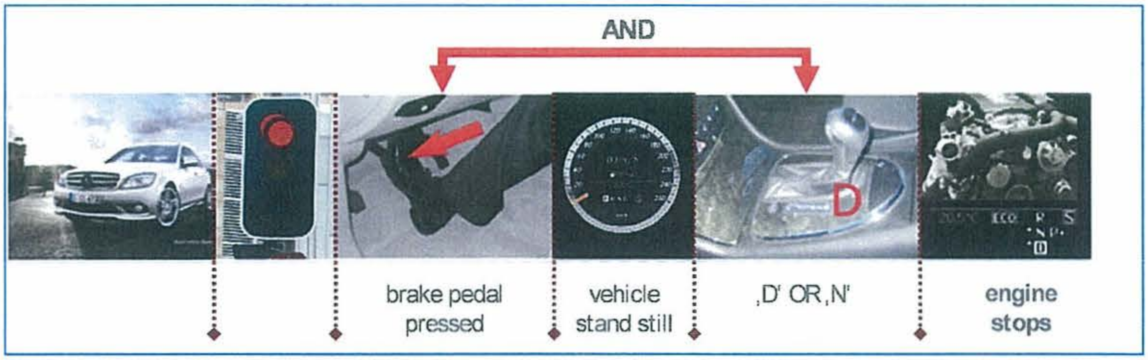


Figure 1: Normal Operation Automatic Stop

2.2 Automatic Start

For the automatic start function one or more events restart the engine:

- brake pedal is released
- acceleration pedal is pressed
- shift lever position 'R' is engaged
- driver unfastens seatbelt
- system conditions require a running engine (Section 3)

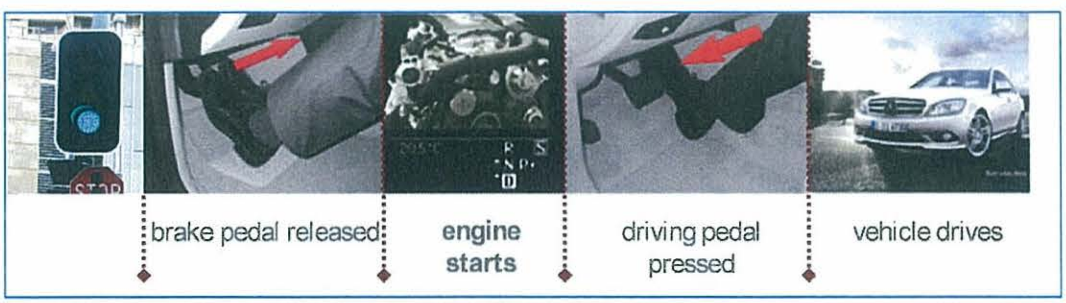


Figure 2: Automatic Transmission Vehicle; Normal Operation Automatic Start

3 System Overview

[redacted]

To operate as described the ECO start-stop function must be coordinated with related safety, operational, and convenience systems. This coordination function is depicted in Figure 3. The coordination and monitoring of the related systems is [redacted]

3.1 Initial Conditions

The ECO start-stop function is automatically activated after key start at a speed of 5 mph.

3.2 Engine

To achieve a highly reliable and smooth automatic restart, Mercedes-Benz engines are equipped with [redacted] Operating parameters related to normal vehicle functioning that affect start-stop are set forth below.

3.2.1 Gasoline

Specified engine conditions must be fulfilled to authorize an automatic stop.

Engine Condition	automatic stop enable threshold
Engine Oil Temperature	[redacted]
Coolant Temperature	
Exhaust System	

Table 1: Gasoline Engine Automatic Stop Conditions

Engine Condition	automatic restart threshold
Maximum time in automatic stop	3 min

Table 2: Gasoline Engine Restart Conditions

3.2.2 Diesel

Specified engine conditions must be fulfilled to authorize an automatic stop.

Engine Condition	automatic stop enable threshold
Engine Oil Temperature	[redacted]
Coolant Temperature	
Fuel Temperature	
Minimum Tank Level	

Table 3: Diesel Engine Automatic Stop Conditions

Engine Condition	automatic restart threshold
Maximum time in automatic stop	3 min

Table 4: Diesel Engine Restart Conditions

3.3 Transmission

To maintain the necessary oil pressure to operate the automatic transmission while the combustion engine is in automatic stop, the automatic transmission is equipped with a secondary electric oil pump.

This oil pump is activated at the beginning of an automatic stop. When the engine restarts, the secondary oil pump is deactivated.

Automatic Transmission Condition	automatic stop enable threshold
Transmission Oil Temperature	[redacted]

Table 5: Automatic Transmission Automatic Stop Conditions

3.4 12V Power Net

The supplemental 12V Power Net system takes over the power supply for all electrical components when the engine is restarting. This allows the main battery to be available for restart while maintaining all electrical functions. The supplemental 12V battery is recharged as necessary by the main generator. If either the main battery or 12V supplemental battery malfunctions and cannot maintain functionality, a warning symbol is activated in the display and the driver is told to visit the dealership.

Power Net Condition	automatic stop enable threshold
Outside Temperature	[redacted]
Battery Temperature	
State of charge (SOC) of Main Battery	

Table 6: 12V Power Net Automatic Stop Conditions

3.5 ESP / Brake System

While the engine is stopped, the brake booster's vacuum pump is not active.

To ensure that there is always enough vacuum in the brake booster to support a driver's brake operation while at automatic stop, the [redacted]

ESP / Brake System Condition	automatic stop enable threshold
Brake Booster Vacuum	[redacted]

3.6 Air Conditioning / Climate Control

A safety aspect of the air conditioning's logic for the start-stop system in cold weather is to assure that the engine is not cut off if the windows are fogged. A special fog sensor is installed in the front windshield to detect window fogging and to activate the defrost function. During limited times when the defrost function is required, the start-stop system does not operate.

Document in Support of Request for GHG Credits

Attachment I
Graphic Representation of MB Start-Stop System

CONFIDENTIAL BUSINESS INFORMATION REDACTED

Graphic Representation of Mercedes Benz Start-Stop System

Attachment I

DAIMLER

Confidential Business Information Redacted

[redacted]

[redacted]

[redacted]

[redacted]

Attachment I

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Document in Support of Request for GHG Credits

Attachment J
Bosch Sheet on Electric Heater Pump

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[redacted]

Document in Support of Request for GHG Credits

Attachment K
Excerpt from German Magazine AutoBild

Mercedes-Benz Start/Stop-System: C350 Rated #1 by German Magazine AutoBild

sportscars | allrad | tuning | motorsport | greencars | klassik | ConnectedCar | LOGIN

ABO | IPAD | MOBIL | NEWSLETTER | RSS

Suchbegriff oder Inserats-ID eingeben SUCHEN

AUTO-KATALOG | TEST | NEWS | RATGEBER | AUTOMARKT | AKTIONEN | VIDEO

BILDERGALERIE

10.04.2012

Start-Stopp-Systeme im Test

Ein Start-Stopp-System spart Sprit. Aber es raubt Zeit. Wie viel, wollten wir genau wissen und haben bei dreizehn Fahrzeugmodellen nachgemessen. Die Unterschiede sind größer als gedacht.

Bild 27 von 28

... eine elektrische Getriebeölpumpe. Das Start-Stopp-System kostet so überhaupt keine Zeit. Zeit bis Tempo 20: 1,58 Sekunden ohne Start-Stopp, 1,58 Sekunden mit Start-Stopp.

ZURÜCK ZUM ARTIKEL

*"The start/stop-system does not cost time at all: Time to go from zero to 20 kph 1.58 s without start/stop. 1.58 s with start/stop."**

** 13 vehicles tested,*
Δt between 0 and 1.3 s/85%

Document in Support of Request for GHG Credits

Attachment L
Durability Information on MB Start-Stop Technology

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Mercedes-Benz

Durability Info On Start/Stop System

- Durability full useful life is defined with [redacted] stop-start events for the system (derived from a statistical study with [redacted] here in Europe)

Actual Status Of Start-Stop Durability Runs On The Road

In total [redacted] vehicles with different engines performing a durability program for our start-stop system. [redacted] vehicles have already complet e durability run and so far no outage.

[redacted]

Mercedes-Benz

Actual Status Of Start-Stop Durability Runs On The Test Bench

In total [redacted] systems with different engines performing a durability program for our start-stop system on the test bench. [redacted] configurations have alr[redacted]y completed the durability run and so far no outage.

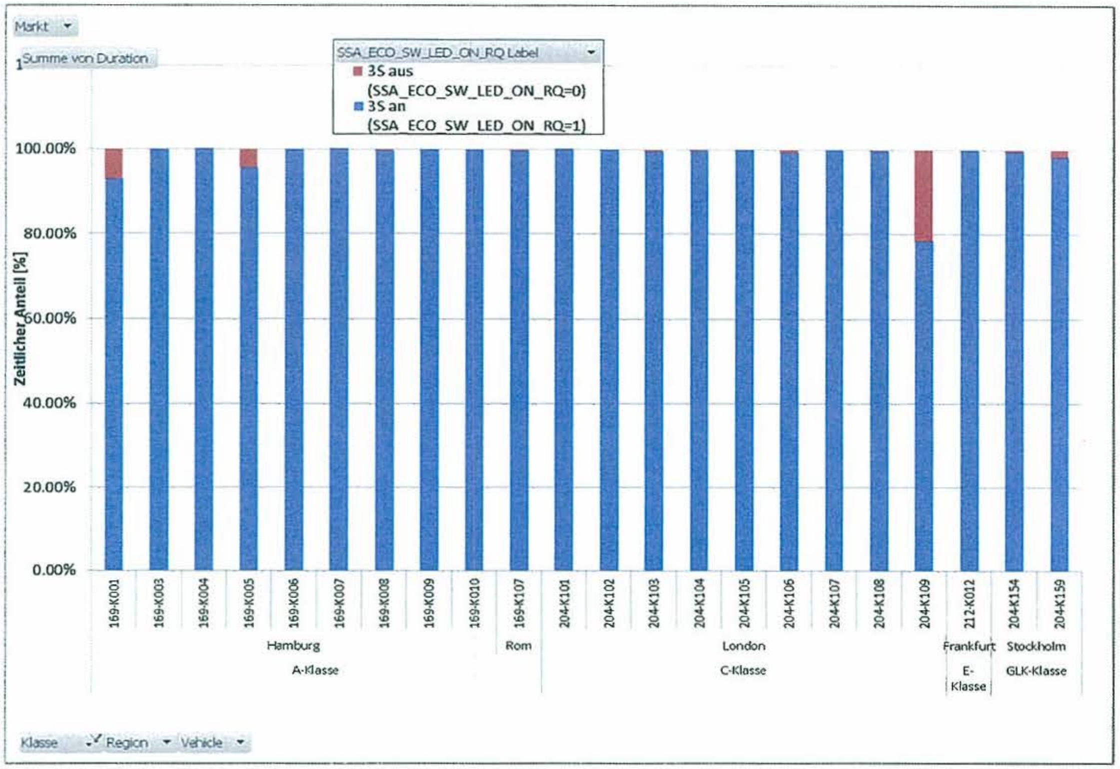
[redacted]

Document in Support of Request for GHG Credits

Attachment M
ECO Button Survey Data

Preliminary ECO Button Survey Data - European Market

Class	Region	Vehicle	ECO-Button "on" (3S enabled)	ECO-Button "off" (3S de-activated)
A-Class	Hamburg	169-K001	92.95%	7.05%
A-Class	Hamburg	169-K003	99.96%	0.04%
A-Class	Hamburg	169-K004	100.00%	0.00%
A-Class	Hamburg	169-K005	95.55%	4.45%
A-Class	Hamburg	169-K006	99.97%	0.03%
A-Class	Hamburg	169-K007	99.99%	0.01%
A-Class	Hamburg	169-K008	99.72%	0.28%
A-Class	Hamburg	169-K009	99.89%	0.11%
A-Class	Hamburg	169-K010	99.95%	0.05%
A-Class	Rom	169-K107	99.70%	0.30%
C-Class	London	204-K101	100.00%	0.00%
C-Class	London	204-K102	99.84%	0.16%
C-Class	London	204-K103	99.51%	0.49%
C-Class	London	204-K104	99.72%	0.28%
C-Class	London	204-K105	99.81%	0.19%
C-Class	London	204-K106	99.28%	0.72%
C-Class	London	204-K107	99.80%	0.20%
C-Class	London	204-K108	99.65%	0.35%
C-Class	London	204-K109	78.48%	21.52%
E-Class	Frankfurt	212-K012	99.90%	0.10%
GLK-Class	Stockholm	204-K154	99.51%	0.49%
GLK-Class	Stockholm	204-K159	98.26%	1.74%
Overall Results			**99.06%**	**0.94%**



Document in Support of Request for GHG Credits

Attachment N
Survey Vehicle Stop Times

	Number of Stops (v <0.1 km/h)			331,033.0								
		Duration of stop [s]										
Vehicle	trip length [km]	[0; 15[	[15; 30[	[30; 45[	[45; 60[	[60; 75[	[75; 90[	[90; 105[	[105; 120[	[120; 135[	[135; 150[	[150; 165[	[165; 180[
USA2010-K01-ML320 BT	21536.3	19030	4572	2039	1126	641	363	210	151	78	48	45	45
USA2010-K02-ML550	28542.2	8044	1747	905	527	281	198	128	100	47	26	31	27
USA2010-K03-ML350	4387.8	3169	796	351	158	51	41	21	18	14	19	10	6
USA2010-K04-GL320 BT	21090.5	7106	2678	1273	765	387	243	109	72	56	32	22	13
USA2010-K05-GL450	25174.5	10571	3019	1561	1027	606	411	279	182	102	49	55	42
USA2010-K06-R350	21892.4	10319	2879	1326	709	391	231	112	75	45	36	26	25
USA2010-K07-SL550	4778.2	1722	396	207	85	56	34	13	9			1	1
USA2010-K08-CLK350	14267.2	3991	1400	841	497	274	163	127	50	31	17	2	16
USA2010-K09-E320 BT	9404.1	2043	680	271	176	62	47	26	15	10	7	3	5
USA2010-K10-E350W	5983.4	3254	894	455	268	135	104	78	55	38	17	17	10
USA2010-K11-E350W	47416.3	14807	4363	2011	1408	624	347	174	124	82	68	71	54
USA2010-K12-E550	18975.4	5412	1966	1149	888	554	398	251	130	58	43	25	17
USA2010-K13-E550	37054.5	8127	2166	1096	794	412	299	142	77	53	54	23	25
USA2010-K14-E350W4	25750.1	19193	5617	2043	868	379	169	102	70	53	39	37	26
USA2010-K15-GLK350	12293.0	3632	1012	485	341	122	73	25	11	2	2	4	1
USA2010-K16-CLS550	6769.3	6001	1206	700	470	303	167	107	90	39	24	23	15
USA2010-K17-C300W	19907.0	8417	2795	1395	767	400	295	105	74	46	30	21	19
USA2010-K18-C300	4613.2	2259	864	352	184	95	69	40	27	9	6	4	4
USA2010-K19-C350	3381.2	1994	492	225	148	84	51	26	16	10	15	2	6
USA2010-K20-C350	12128.5	5899	1750	870	547	283	175	82	34	9	5	4	12
USA2010-K21-Eclass	10934.1	7435	2403	1139	723	370	157	99	85	19	10	13	13
USA2010-K22-C300	23648.6	4296	1418	614	340	185	79	41	29	13	11	3	4
USA2010-K23-C300W4	21378.9	11189	2987	1719	924	335	149	96	73	60	37	26	25
USA2010-K24-FORTWO	2858.4	2501	696	329	182	53	20	9	22	8	2	1	
USA2010-K25-ML350	34144.7	10102	3784	1533	810	488	275	203	123	61	56	28	23
USA2010-K27-S600V	9939.7	3906	1248	825	466	213	139	62	31	15	17	8	9
USA2010-K28-FORTWO	8515.8	5409	1458	819	367	110	73	18	15	11	6	5	9
USA2010-K29-S550W	30908.7	6590	2157	1232	857	431	219	208	58	38	25	27	13
USA2010-K30-FORTWO	12913.7	3280	1789	946	625	339	173	107	62	11	7	5	4
all	**500,588.0**	**199698**	**59232**	**28711**	**17047**	**8664**	**5162**	**3000**	**1878**	**1018**	**708**	**542**	**469**
Percentage of stops [%]		60.33%	17.89%	8.67%	5.15%	2.62%	1.56%	0.91%	0.57%	0.31%	0.21%	0.16%	0.14%
Percentage kumulated stops [%]		60.33%	78.22%	86.89%	92.04%	94.66%	96.22%	97.12%	97.69%	98.00%	98.21%	98.38%	98.52%
average duration of stops [s]	25.9												

Vehicle	[180; 240[	[240; 300[	[300; 360[	[360; 420[	[420; 480[	[480; 540[	[540; 600[	[600; 660[	[660; 720[	[720; 780[	[780; 840[
USA2010-K01-ML320 BT	137	65	44	51	34	26	13	20	9	4	10
USA2010-K02-ML550	59	37	26	18	20	7	11	10	4	2	3
USA2010-K03-ML350	21	10	8	2	6	2	2	2	2	2	
USA2010-K04-GL320 BT	65	39	26	18	7	9	8	6	4	6	
USA2010-K05-GL450	127	80	55	49	32	35	16	14	12	10	13
USA2010-K06-R350	61	55	46	40	15	20	16	10	9	6	5
USA2010-K07-SL550	6	1	1	1			1				
USA2010-K08-CLK350	21	11	10		5	1		4	1	3	2
USA2010-K09-E320 BT	7	9	3	4		4	3	1	1	2	2
USA2010-K10-E350W	24	25	11	10	9	8	7	5	1	5	3
USA2010-K11-E350W	145	89	55	42	19	17	18	16	6	6	6
USA2010-K12-E550	55	19	11	4	5	3	2	1		2	
USA2010-K13-E550	59	22	30	12	9	5	8	4	5	2	4
USA2010-K14-E350W4	90	78	47	32	33	19	7	14	6	3	4
USA2010-K15-GLK350	8	6	1	2	1	1					
USA2010-K16-CLS550	43	27	13	11	7	3	2	1	2	2	2
USA2010-K17-C300W	89	58	51	34	24	20	14	14	14	9	12
USA2010-K18-C300	8	3	4	2	5		1		2		
USA2010-K19-C350	16	11	4	1	3			1	1		3
USA2010-K20-C350	11	5	5	6	2	1			1	1	1
USA2010-K21-Eclass	28	13	18	12	6	4	6	2		1	1
USA2010-K22-C300	21	5	3	1	1	1	2		1		
USA2010-K23-C300W4	89	52	35	18	18	17	15	13	9	7	8
USA2010-K24-FORTWO	2	1									
USA2010-K25-ML350	77	52	35	20	13	5	7	4	3	2	1
USA2010-K27-S600V	19	6	6	3	4	3		1		4	
USA2010-K28-FORTWO	27	8	2	3	1	3	2		2	1	
USA2010-K29-S550W	34	23	24	8	9	4	4	3	6	2	1
USA2010-K30-FORTWO	14	78		1		1					1
all	**1363**	**888**	**574**	**405**	**288**	**219**	**165**	**146**	**101**	**82**	**82**
Percentage of stops [%]	0.41%	0.27%	0.17%	0.12%	0.09%	0.07%	0.05%	0.04%	0.03%	0.02%	0.02%
Percentage kumulated stops [%]	98.93%	99.20%	99.37%	99.49%	99.58%	99.65%	99.70%	99.74%	99.77%	99.80%	99.82%
average duration of stops [s]											

Vehicle	[840; 900[	[900; 960[	[960; 1020[	[1020; 1080[	[1080; 1140[	[1140; 1200[	[1200; 1260[	[1260; 1320[	[1320; 1380[	[1380; 1440[	[1440; 1500[
USA2010-K01-ML320 BT	9	4	6	3	3	4	4	1	1	2	2
USA2010-K02-ML550	7	2	2	2	1	1			1	1	
USA2010-K03-ML350		1			1			1		1	
USA2010-K04-GL320 BT	3	1	1	1	1	1	2			1	
USA2010-K05-GL450	5	7	8	7	4	4	4	1	5	3	1
USA2010-K06-R350	3	7	3	5	3	2	1	1		1	2
USA2010-K07-SL550	1		1	1							
USA2010-K08-CLK350	1		2	2		2	1		1		
USA2010-K09-E320 BT			1				1			1	
USA2010-K10-E350W	1	2	2	2			1			1	
USA2010-K11-E350W	4	8	2	3	2	4	2			3	1
USA2010-K12-E550	1	1									
USA2010-K13-E550	4	3	2	3			1	1			1
USA2010-K14-E350W4	9	3	1	2	3	1	1			3	3
USA2010-K15-GLK350											
USA2010-K16-CLS550				2							2
USA2010-K17-C300W	7	3	9	3	6	4	6	5	1	5	3
USA2010-K18-C300			1		1	1			1		1
USA2010-K19-C350				1					1		
USA2010-K20-C350		1					3			1	2
USA2010-K21-Eclass			1						1	1	1
USA2010-K22-C300											
USA2010-K23-C300W4	4	3	6	5	2		4	3	1		3
USA2010-K24-FORTWO											
USA2010-K25-ML350	1		1		1	1	2				
USA2010-K27-S600V			1					1			
USA2010-K28-FORTWO				1	1				2		
USA2010-K29-S550W	1	1		2	1	2					
USA2010-K30-FORTWO				1							
all	**61**	**47**	**50**	**46**	**30**	**27**	**33**	**14**	**15**	**24**	**22**
Percentage of stops [%]	0.02%	0.01%	0.02%	0.01%	0.01%	0.01%	0.01%	0.00%	0.00%	0.01%	0.01%
Percentage kumulated stops [%]	99.84%	99.85%	99.87%	99.88%	99.89%	99.90%	99.91%	99.91%	99.92%	99.93%	99.93%
average duration of stops [s]											

Vehicle	[1500; 1560[	[1560; 1620[	[1620; 1680[	[1680; 1740[	[1740; 1800[	[1800; 3600[	[3600; 5400[	[5400; 7200[	alle	Stop Events Per Vehicle [%]
USA2010-K01-ML320 BT		1	2	1	1	14	2		28821	8.71%
USA2010-K02-ML550	1		1	1	1	8			12287	3.71%
USA2010-K03-ML350		1			1	1			4718	1.43%
USA2010-K04-GL320 BT	1								12956	3.91%
USA2010-K05-GL450	6	6	5	4	4	17	2		18440	5.57%
USA2010-K06-R350		2	2	1		13	2	1	16506	4.99%
USA2010-K07-SL550	1								2538	0.77%
USA2010-K08-CLK350	1			1		6			7484	2.26%
USA2010-K09-E320 BT						2			3386	1.02%
USA2010-K10-E350W				1		1			5444	1.64%
USA2010-K11-E350W	1	1			1	6	1		24591	7.43%
USA2010-K12-E550									10995	3.32%
USA2010-K13-E550	1				1	5	1		13451	4.06%
USA2010-K14-E350W4			1			11		1	28968	8.75%
USA2010-K15-GLK350									5729	1.73%
USA2010-K16-CLS550		1				2	1	1	9267	2.80%
USA2010-K17-C300W	1	2	2	3	2	33	3	4	14805	4.47%
USA2010-K18-C300									3943	1.19%
USA2010-K19-C350									3111	0.94%
USA2010-K20-C350						2	2		9714	2.93%
USA2010-K21-Eclass						1	1		12563	3.80%
USA2010-K22-C300									7068	2.14%
USA2010-K23-C300W4		1	1			5	1	1	17941	5.42%
USA2010-K24-FORTWO						1			3827	1.16%
USA2010-K25-ML350						2			17713	5.35%
USA2010-K27-S600V								1	6988	2.11%
USA2010-K28-FORTWO	1								8354	2.52%
USA2010-K29-S550W						1			11981	3.62%
USA2010-K30-FORTWO									7444	2.25%
all	**14**	**15**	**14**	**12**	**11**	**131**	**16**	**9**	**331033**	**100.00%**
Percentage of stops [%]	0.00%	0.00%	0.00%	0.00%	0.00%	0.04%	0.00%	0.00%		
Percentage kumulated stops [%]	99.94%	99.94%	99.95%	99.95%	99.95%	99.99%	100.00%	100.00%		
average duration of stops [s]										

Document in Support of Request for GHG Credits

Attachment O
Projected Sales Data MY 2012-2014

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Sales of MB Start-Stop Vehicles by Testgroup and MY

MY12

Models	Model Name	Vehicle Class	Transm.	Act. Sales TierII	Act. Sales LEVII	SUM
[redacted]						

MY13

Models	Model Name	Vehicle Class	Transm.	Proj. Sales TierII	Proj. Sales LEVII	SUM
[redacted]						

Sales of MB Start-Stop Vehicles by Testgroup and MY

MY14

Models	Model Name	Vehicle Class	Transm.	Proj. Sales TierII	Proj. Sales LEVII	SUM
[redacted]						

Document in Support of Request for GHG Credits

Attachment P
GHG Off-Cycle Credits for Additional Technologies

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USA GHG Off-Cycle CO_2 Credits

Thermal control technologies - Infrared Glazing

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GHG Off-Cycle Credits: Thermal control technologies: Glass or glazing

Regulation:

§ 86.1869-12 CO_2 credits for off-cycle CO_2-reducing technologies.

(viii) *Thermal control technologies*. The maximum credit allowed for thermal control technologies is limited to 3.0 g/mi for passenger automobiles and to 4.3 g/mi for light trucks.

(A) *Glass or glazing*. Glass or glazing credits are calculated using the following equation, and rounded to the nearest 0.1 grams/mile:

$$\text{Credit} = \left[Z \times \sum_{i=1}^{n} \frac{T_i \times G_i}{G} \right]$$

Where:

Credit = the total glass or glazing credits, in grams per mile rounded to the nearest 0.1 grams/mile. The credit may not exceed 2.9 g/mi for passenger automobiles or 3.9 g/mi for light trucks;

Z = 0.3 for passenger automobiles and 0.4 for light trucks;

G_i = the measured glass area of window *i*, in square meters and rounded to the nearest tenth;

G = the total glass area of the vehicle, in square meters and rounded to the nearest tenth;

Ti = the estimated temperature reduction for the glass area of window *i*, determined using the following formula:

$$T_i = 0.3987 \times (Tts_{base} - Tts_{new})$$

Where:

Tts_{new} = the total solar transmittance of the glass, measured according to ISO 13837, "Safety glazing materials – Method for determination of solar transmittance" (incorporated by reference in §86.1).

Tts_{base} = 62 for the windshield, side-front, side-rear, rear-quarter, and backlite locations, and 40 for rooflite locations.

For purposes of this proposal, EPA considers the baseline Tts to be 62% for all glazing locations, except for rooflites and rear side glazings of CUVs, SUVs, and minivans, which have a baseline Tts of 40%.

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Attachment P

MB Glazing
Total solar transmittance rate

Based on calculation of the total solar transmittance rate (Tts values) according to ISO13837, the Mercedes Benz infrared glazing qualifies for off-cycle credits for the following technologies:

- Calulated Tts-values according to ISO 13837
  - Non Infrared Glas: [redacted]
  - Infrared multilayer glass (Sungate)
  - Front window
  - Panorama roof:
  - Privacy glazing:

In the following table, Mercedes Benz has calculated the off-cycle credits for each eligible vehicle variant and identified if the vehicle is equipped with a panorama roof or not.

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Calculation of the Off-Cycle Potential

Vehicle	Z= 0.3 PKW Z= 0.4 LDT	Panorama roof												
PC			Glass	Front	front left	front right	rear left	rear right	Window in left sidewall	Window in right sidewall	Rear	Panorama roof	Total Area	Off Cycle Credit
			Tts-Value Base PC [%]	62	62	62	62	62	-	-	62	40	[m²]	[g CO2/ mile]
S Class			Tts-Value [%]	[redacted]										
			Area [m²]											
	0,3	no											2,55	1,7
	0,3	yes											3,22	1,5
LDT			Glass	Front	vorn links	vorn rechts	hinten links	hinten rechts	Fenster in Seitenwand links	Fenster in Seitenwand rechts	Heck	Panorama -Dach	Total Area	Off Cycle Credit
			Tts-Value Base LDT [%]	62	62	62	40	40	40	40	62	40		
ML Class without Night View			Tts-Value [%]	[redacted]										
			Area [m²]											
	0,4	no											2,39	0,9
	0,4	yes											3,09	0,8
			Tts-Value Base LDT [%]	62	62	62	40	40	40	40	62	40		
GL Class without Night View			Tts-Value [%]	[redacted]										
			Area [m²]											
	0,4	no											2,64	0,9
	0,4	yes											3,34	0,8
			Tts-Value Base LDT [%]	62	62	62	40	40	40	40	62	40		
ML - Class with Night View			Tts-Value [%]	[redacted]										
			Area [m²]											
	0,4	no											2,39	1,5
	0,4	yes											3,09	1,2
			Tts-Value Base LDT [%]	62	62	62	40	40	40	40	62	40		
Gl Class with Night View			Tts-Value [%]	[redacted]										
			Area [m²]											
	0,4	no											2,64	1,5
	0,4	yes											3,34	1,2

GHG Regulation Daimler values Calculated

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Attachment P

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MB Glazing
Off-cycle credit calculation

Base on the previous calculations, Mercedes Benz is claiming off-cycle credits for glazing technologies, which reduce the solar heat transmittance into the vehicles, ranging from 0.8 g/mi to 1.7 g/mi, depending on the vehicle type and equipment.

Mercedes Benz believes that the determination of such small potentials (0.8 – 1.7 g/mi) via dyno testing is not adequate (i.e., the 5-cycle test), as the test to test variations could easily be bigger than that. In order to evaluate potentials in this magnitude, the calculation method is the preferred approach.

As this feature is not standard equipment in all carlines, Mercedes Benz will calculate the respective off-cycle credit potential at the end of the model year based on the sales numbers for the vehicles and feature. Each vehicle equipped with this feature will be eligible for the calculated credit.

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USA GHG Off-Cycle CO_2 Credits

High Efficiency Exterior Lighting

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Attachment P

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High Efficiency Exterior Lighting

Mercedes Benz offers high efficiency exterior lighting for different models in the US. For the following listed types of lights, high efficiency lights of varying wattages are, or will be, available for nearly all models in the MB product portfolio, except the G-Class, by MY2016:

- Low beam
- High beam
- Parking/position
- Turn signal, front
- Side marker, front
- Tail
- Turn signal, rear
- (Side marker, rear)
- License plate

The additional credits MB is requesting are calculated by using EPA's formula from the Joint TSD at 5-71 to 5-72.

High Efficiency Exterior Lighting Credit =

$$\frac{\text{(Baseline lighting wattage} - \text{high efficiency lighting wattage)} \times \text{usage rate} \times \text{VMT fraction} \times 3.2\ \text{g/mi}\ CO_2}{100\ \text{watts}};$$

High Efficiency Exterior Lighting

The Mercedes Benz high efficiency lights qualify for the criteria outlined in the TSD.
See below the minimum requirements from the TSD to qualify for the listed off-cycle credits.

Off Cycle Credits USA - High Efficiency Exterior Lights

	Low beam	High beam	Parking/ position	Turn signal, front	Side marker, front	Tail	Turn signal, rear	License plate	Sum Off Cycle Credit
Baseline [W]	**112,4**	**127,8**	**14,8**	**53,6**	**9,6**	**14,4**	**53,6**	**9,6**	
High Eff (minimum)[W]	66,0	68,8	3,3	13,8	3,4	2,8	13,8	1,0	
credit predefined [g/ mi]	**0,38**	**0,05**	**0,1**	**0,06**	**0,06**	**0,1**	**0,06**	**0,08**	
MB best case high eff. lights	33,0	30,0	4,4	4,0	1,0	2,4	3,5	1,3	
credit predefined [g/ mi]	[redacted]								**0,7**
credit calculated [g/ mi]									**1,1**

At the end of each model year, Mercedes Benz will calculate the corresponding off-cycle credits for each vehicle, based on the types of lights that were installed in production in that specific vehicle. Please see Attachment Q (High Eff Lights-Calculation) for a detailed overview of vehicle specific calculations and a complete list of model availability.

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USA GHG Off-Cycle CO_2 Credits

Active Seat Ventilation

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System description

- Availability:
  - Mercedes-Benz offers active seat ventilation in all carlines with the following exceptions:
    - C- Class and SLK- Class
  - Front seat row; both driver and passenger seats are equipped with seat vents
  - Standard combination: vents + leather seat covers

Steps 1-3

- Function:
  - Pull & push system [redacted]
    - [redacted]
  - [redacted]

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Attachment P

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Construction of air ventilated seats

[redacted]

[redacted]

[redacted]

[redacted]

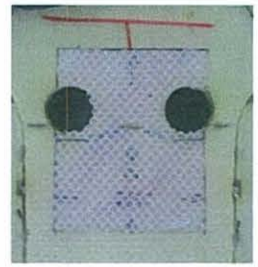
[redacted]

[redacted]

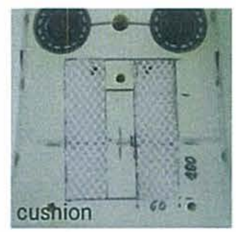
[redacted]

[redacted]

[redacted]



backrest



cushion

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Amount of requested credits

Mercedes Benz is requesting the pre-defined amount of off-cycle credits for active seat ventilation:

- PCs: 1.0 gCO_2/mi
- LDTs: 1.3 gCO_2/mi

As this feature is not standard equipment in all carlines, Mercedes Benz will calculate the respective off-cycle credit potential at the end of the model year based on the sales numbers for the feature. Each vehicle equipped with this feature will be eligible for the pre-defined credit amount.

Document in Support of Request for GHG Credits

Attachment Q
High-Efficiency Lighting Credit Calculations

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High Efficiency Exterior Lights - Off-Cycle Credit Calculations

Type of Lighting	Low beam	High beam	Parking/position	Turn signal, front	Side marker, front	Tail	Turn signal, rear	License plate	Sum Off Cycle Credit
Baseline [W]	**112.4**	**127.8**	**14.8**	**53.6**	**9.6**	**14.4**	**53.6**	**9.6**	
High Eff (min)[W]	66.0	68.8	3.3	13.8	3.4	2.8	13.8	1.0	
credit [g/mi]	**0.38**	**0.05**	**0.1**	**0.06**	**0.06**	**0.1**	**0.06**	**0.08**	
usage rate total	0.2566	0.0254	0.282	0.05	0.282	0.282	0.05	0.282	
S-class									
Serie LED	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option LED	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
SL-class	[redacted]								
Serie Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
SLK-class	[redacted]								
Serie	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
ML-class	[redacted]								
Serie	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
GL-class	[redacted]								
Serie	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
GLK-class	[redacted]								
Serie	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
CLS-Class	[redacted]								
Serie Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option LED	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
E-class -MY13	[redacted]								
Serie	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
E-class MY14-	[redacted]								
Serie (partial LED)	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option LED	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
E-class (coupe, conv.) M	[redacted]								
Serie (partial LED)	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option LED	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
CLA - and GLA-class	[redacted]								
Serie	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
Option Xenon	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								
CL-class MY15-	[redacted]								
Serie	[redacted]								
credit predefined [g/mi]	[redacted]								
credit calculated [g/mi]	[redacted]								

Type of Lighting	Low beam	High beam	Parking/position	Turn signal, front	Side marker, front	Tail	Turn signal, rear	License plate	Sum Off Cycle Credit
SL-class MY17-									
Serie	[redacted]								
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
SLK-class MY17-									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
ML-class MY16-									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
GL-class MY16-									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
GLC-class MY16									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
CLS-class MY15-									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
E-class MY17-									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
E-class (coupe, conv.) MY									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									
C-class MY15-									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option 1									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option 2									
credit predefined [g/mi]									
credit calculated [g/mi]									
CLA - and GLA-class MY1									
Serie									
credit predefined [g/mi]									
credit calculated [g/mi]									
Option									
credit predefined [g/mi]									
credit calculated [g/mi]									