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July 30, 2003

By Fax (202) 366-7882 and by U.S. Mail

Mr. George Person, Chief
Ms. Kelly Schuler, Safety Defect Analyst
Recall Management Division
National Highway Traffic Safety Administration
U.S. Department of Transportation
400 Seventh Street, SW
Washington, D.C. 20590

Re: NHTSA Identification No. 03E-035 Related to Pioneer Electronics (USA) Inc. Mobile Entertainment Division's Supplemental Informational Disclosure and Quarterly Report Regarding GM-X series amplifiers (GM-X372, GM-X374, GM-X572, GM-X574, and GM-X972) and the GM-D amplifier (GM-D500M)

Dear Mr. Person and Ms. Schuler:

Pioneer Electronics (USA) Inc., Mobile Entertainment Division ("PUSA" or "the Company"), supplements the previous Informational Disclosure to the Consumer Product Safety Commission ("CPSC") dated April 24, 2003, and the previous correspondence with the National Highway Traffic Safety Administration ("NHTSA"), dated June 27, July 7, and July 14, 2003, and hereby provides both its 49 CFR Part 573.6 Safety Defect and Noncompliance Information Report and its Part 573.7 Quarterly Report Information.

Pioneer is currently engaged in a voluntary recall of four of its model year 2003 aftermarket car stereo amplifier models as set forth in its previous correspondence. As we write this letter, we are pleased to state that there remain no reports of any bodily injury as a consequence of any design and installation flaws that led us to conduct the voluntary recall of approximately 36,000 amplifiers to protect against a potential safety issue that might arise in connection with an installation contrary to or inconsistent with the Owner's Manual. We also are pleased to report that we are not aware of any fire or other safety hazard suffered by a consumer that was caused by the amplifier condition covered by the recall campaign.

In the weeks since NHTSA granted our request for an extension of time to continue our internal investigation and submit a more comprehensive report, we have conducted a series of in-person interviews with employees of the Company's design affiliate in Springboro, Ohio, Pioneer Industrial Components, Inc. ("PIC"). We also have conducted a review of documents in PIC's possession dating back to the initial design stages for the affected amplifiers. We have further interviewed individuals in Mexico and Japan who were involved in the product development, manufacturing, and design process of the affected amplifiers. Further, we have interviewed employees of our Carson, California-based warranty and service affiliate, Pioneer Electronics Service, National Service Operations Division ("PSE"). We believe that this internal investigation is far more extensive than any previously conducted by the Company in connection with the affected amplifiers.

Our investigation over the past few weeks has broadened the Company's understanding of the chronology of events leading up to the identification of design flaws in the aftermarket amplifiers that we have now voluntarily recalled, and broadened the Company's awareness of flaws in our internal processes for evaluating and testing these amplifiers at PIC. As a result of this investigation, the Company has identified several steps in the design and testing process that require change. We have already instituted several internal process improvements and are considering other internal changes as well, including the possible discipline and/or reassignment of certain employees with direct responsibility for identified shortcomings. Unfortunately, this further investigation also revealed facts and documents of which PUSA was previously not aware at the time of its CPSC report, dated April 24, 2003. If PUSA had known of these newly discovered facts and documents earlier, we would have avoided the necessity and corporate embarrassment of the two-step recall campaign – the first being the CPSC repair or replacement program this Spring and the second being the NHTSA full recall and reimbursement / exchange program which we began earlier this month. This report which includes facts recently learned by PUSA, therefore, corrects some mistakes in our original report to the CPSC and in our report to NHTSA of July 7, 2003.

I. Identity of Recalled Items of Equipment

A. The Original CPSC Repair or Replacement Recall Campaign

The Company's disclosure to the CPSC in its letter of April 24, 2003, focused on the car stereo amplifier commonly identified as Model No. GM-X972. The Company also identified four other car amplifier models which shared the same general integrated circuit ("IC") chip design, including the GM-X574, GM-X572, GM-X374, and GM-X372. (The numerical component of the model number corresponds to the power output

and number of channels for the amplifier; the highest number model, X972, has the highest rated power output per channel, and the last digit corresponds to the number of channels in the amplifier, 2 or 4.) All five model year 2003 after-market amplifiers are collectively referred to herein as the "2003 GM-X Amplifiers."

Even though PUSA had received reports from independent retailers of damage only to the highest power-output amplifier (the 150-watt per channel Model No. GM-X972), PUSA originally recalled all of the 2003 GM-X Amplifiers pursuant to its voluntary CPSC repair or replacement campaign. The original campaign resulted in the collection of approximately 60% of the recalled amplifiers, as of the time the current second recall campaign began. The original recall campaign is ongoing as to models GM-X372 and GM-X374, which remain in production, but the other GM-X models have been discontinued and have been fully recalled pursuant to the Company's second recall campaign, which is the focus of this Report and to which we now turn.

B. The Current NHTSA Full Recall Campaign

The Company's current second recall campaign for its car stereo aftermarket amplifiers commenced on July 7, 2003. The second recall campaign is a full recall and reimbursement / exchange program involving the entire model year 2003 product line of analog car stereo amplifier Model Nos. GM-X972, GM-X574, and GM-X572, and another type of amplifier, digital model GM-D500M. The GM-D500M was previously discontinued in April of 2003, and fewer than 900 of these digital units were sold to consumers.

The second recall campaign does not include Model Nos. GM-X374 or GM-X372 because repeated testing and analysis of these models have not resulted in any potential safety hazard, even when PIC's testing engineers were able to induce a failure by creating an exceptionally unlikely worst-case scenario. We can replicate a failure mode in the laboratory and under real world conditions that is a safe failure mode, with no flame and maximum external shell temperatures of approximately 120° F before the unit powers off. Notably, there have been no reports from the field of any failure mode in these lowest-power output models. Model GM-X374 is rated at only 35 watts per channel and has a single 30-amp fuse that provides an earlier over-current protection than the higher-powered amplifiers being recalled; Model No. GM-X372 is rated at only 50 watts per channel and has a single 25-amp fuse as compared to the higher rated fuses on the other GM-X series models being recalled.

The chart below summarizes the key attributes of all Pioneer car amplifier models for model year 2003 that employ an integrated circuit chip design, and indicates whether each is included in or excluded from the second recall campaign. Approximately 63% of the aftermarket amplifiers manufactured for PUSA by PIC (including its affiliates and

subcontractors) employed the IC design, for the time period the 2003 GM-X Amplifiers and the GM-D500M were being manufactured.

Amplifier Model	IC Component	Power Output/ Channel	Fuses	Current Recall Status
GM-X972	Two ST Micro TDA7293	150 watts	Two 30 Amp	Full recall; discontinued model. Full refund or exchange to different model
GM-X572	ST Micro TDA7293	75 watts	Two 20 Amp	Full recall; discontinued model. Full refund or exchange to different model
GM-X574	ST Micro TDA7294	50 watts	Two 25 Amp	Full recall; discontinued model. Full refund or exchange to different model
GM-D500M	ST Micro TDA7570	300 watts	Two 30 Amp	Full recall; discontinued model. Full refund or exchange to different model
GM-X372	ST Micro TDA7294	50 watts	Single 25 Amp	Not included in second recall; previously modified and tested safe
GM-X374	ST Micro TDA7294	35 watts	Single 30 Amp	Not included in second recall; previously modified and tested safe.

II. Identifying the Recall Population

The Company's recall population includes three Pioneer model year 2003 model GM-X analog car aftermarket amplifiers and the Pioneer digital car aftermarket amplifier model GM-D500M. The table below identifies the recall population of the model year 2003 GM-X and GM-D car stereo amplifier units that are the subject of the Company's second recall campaign. Because the problems with the amplifiers at issue pertain to design issues, the recall population includes all amplifiers for each of the four models listed. It should be noted that the number of units collected by the Company pursuant to

the newly initiated second recall campaign do not reflect the amplifiers that have already been collected by dealers and distributors but have not yet been shipped due to delays by the Company in providing return shipping labels and other necessary shipping information to dealers and distributors. The Company expects to receive those amplifiers soon.

Amplifier Model	Approximate # Sold to Dealers/Distributors for Sale to Consumers (Net of Returns from 1st Recall, except for D500M)	# Returned to Date per 2nd Recall as of 7/23/2003 (Total Returns of D500M) **2nd Recall began 7/7/2003	% of Returns to Date
GM-X972	18,532	609	3.3%
GM-X572	11,803	411	3.5%
GM-D500M	974	98	10.1%
GM-X574	4,648	466	10.0%

III. Describing the Defect in the Affected Amplifiers

The Company believes that none of the failures of the 2003 GM-X Amplifiers has occurred when the amplifier was properly installed with a 4-Ω bridge or greater resistive load in accordance with the Owner's Manual, which specifies a 4-Ω maximum resistive load configuration in several places[3]. An exemplar Owner's Manual for each of the 2003 GM-X Amplifiers is enclosed as Exhibit 1 with the mailed original of this report.

The design flaw in the recalled Models GM-X972, GM-X572, and GM-X574 is an insufficient over-current protection when a series of product-stressing conditions occur. Those conditions, which appear to violate the instructions in the Owner's Manual,

[3] For purposes of clarity, "speaker resistive load" and "speaker impedance" are inversely related: the greater the load, the lower the impedance. Larger speakers such as subwoofers, for example, generally produce greater loads and lower impedance.

include: a very low speaker impedance such as that created when the amplifier is improperly installed or connected to sub woofers in a manner contrary to the Pioneer Owner's Manual and contrary to the models' installation instructions; the use of speakers or subwoofers that are less compatible with a Pioneer amplifier than Pioneer brand speakers or subwoofers; the use of speaker wire of a smaller gauge than Pioneer expected to be used for connections to the amplifier, all together with maximum or near maximum gain and volume settings being selected by the consumer. The Owner's Manual for all of the 2003 GM-X Amplifiers specifies a 4-Ω maximum resistive load configuration in several places, and the Manual states that the amplifier may catch fire, emit smoke or become damaged if the installation does not conform to the standards and specifications listed there.

We believe that the potential safety hazard to consumers – even in such cases of improper installation – is remote because of the steel fire-resistant external shell and the fire-resistant printed circuit board common to all of the affected amplifiers. In each case the fire-resistant printed circuit board, resistors, subheatsink, chips, power rails, and all other electric current-related components reside within this steel, fire-resistant external shell. We have attached as Exhibit 2 to this report a set of photographs showing a fully assembled Model GM-X972, and one disassembled to show the top of the protective external casing removed. When the failure mode occurs, the overheat condition that can scorch the surface of the fire-resistant printed circuit board is thus self-contained within the amplifier unit, and any brief appearance of a flame that may occur inside an affected amplifier is shielded from the vehicle interior or a consumer by this rugged external fire-resistant shell. Our current investigation suggests that in the failure mode the output field effect transistors ("FETs") within the IC chip exceed their electrical power dissipation capacity and fail. We believe that when this occurs, depending on the power output of the unit and the electrical current draw under extreme conditions, the FET failure destroys the chip, creates a thermal event in the DC-to-DC converter FETs, overheats that portion of the printed circuit board and the nearby resistors, and in some instances has resulted in a flash of flame across the surface of the circuit board for up to five seconds, at which point the FET failure is complete and the unit de-powers. We have attached as Exhibit 3 to this report a set of images received from service centers at one of the Company's retailers, Best Buy, demonstrating the post-failure condition of several circuit boards.

In the five to ten seconds from the beginning to the conclusion of the failure mode, and for a short period of time after the thermal event has concluded, the fire-resistant steel external shell of an affected unit may become hot to the touch. By way of reference, the Company notes that in testing of competitors' amplifiers under laboratory conditions, the exterior surface of tested competitor amplifiers reached over 170° F for

one unit, and over 200° F in two other units, without a failure. This temperature would also be considered to be hot to the touch even without a thermal event.

When a thermal event occurs and the FETs fail and the printed circuit board becomes scorched, some wisps of smoke appear within the enclosed unit and an appearance of smoke may emerge through tiny slits at the edges of the external shell. There are no such slits adjacent to the path of the brief flash of flame in the affected high-powered amplifiers, and PIC was unable to ever induce any flame to appear outside an affected unit in any failure mode.

The design flaw in the recalled digital car amplifier model GM-D500M has yet to be fully identified, but it appears to involve a failure to protect fully against a thermal event in the event of over-current. We have outlined the current state of our knowledge regarding the GM-D500M defect in a separate chronology (Section IV F., below) that immediately follows the chronology relating to the analog amplifiers.

IV. Chronology in Determining the Defect of the Amplifiers

The Company's design and manufacturing affiliate, PIC, determined relatively early in the development process for the 2003 GM-X Amplifiers that over-current protection was a potential problem. Accordingly, during product development, PIC developed a series of protective circuits and guards against excessive current flow. At each step of the design process through product release, PIC believed that the risk of product failure was limited to damage to the product itself rather than any safety concern. Because the damage to the product revealed by the development testing affected only the operation and function of the amplifier and PIC believed the over-current protection problem to have been addressed, PIC released the product; PIC would never have originally released the product to the market if PIC's engineering and quality control departments believed that they had failed to resolve the over-current issue or if they believed there was a safety risk involved. As we now know, with the benefit of hindsight, they did not completely resolve the over-current issue prior to the model year 2003 product release at the end of 2002, and they did not fully guard against the possibility that installers or consumers were mis-installing the amplifiers contrary to the installation instructions and warning in the Owner's Manual.

A. Development History And The Use of A New Integrated Chip Design for Analog Amplifiers.

In the Fall of 2001, PIC considered the use of an integrated circuit design for the power module in the amplifiers. The previous generation amplifiers that PIC

designed/manufactured for PUSA had all used a discrete component design where each separate component was separately attached to the printed circuit board instead of bundled in the integrated package of an IC design. For example, the output FETs that ultimately were implicated in the thermal events in the 2003 GM-X Amplifiers had been separate components attached to circuit board in prior years' models, but were integrated within the chip in the developing 2003 model year design.

B. Over-Current Protection Inadequacies and Product Development Responses To The Identified Problems

In December 2001, PIC began testing the new IC chips, known as the TDA7293, that it received from the manufacturer, ST Micro. PIC's testing revealed that the IC chips did not have "short-circuit protection," a feature that the IC chips were represented to possess according to the ST Micro product literature. "Short circuit protection" is a feature which forces the chip to shut itself down when excessive current passes through it. A short circuit protection component or design protects against an over-current condition. It also appeared that the IC chip oscillated, *i.e.*, turned off and then back on and then off again, thereby drawing excess current into the chip and ultimately creating a thermal event. PIC believed, and remained convinced throughout development, that the ST Micro TDA7293 was the cause of various problems (*i.e.*, problems that PIC viewed as component failures). Accordingly, PIC worked to develop countermeasures with respect to the IC chip but failed to recognize the root cause of the potential safety issue.

PIC contacted ST Micro and explained its findings. ST Micro replied that the chip's separate "thermal protection" feature would eventually shut down the chip if excessive current were passed through it and the chip became too hot. ST Micro also indicated that none of its other purchasers had reported any failures or problems with the new IC chip as of that time. ST Micro subsequently conceded in early 2002 that the IC chip did not have short circuit protection (and ST Micro appears to have later revised its product literature to change its prior representation about short circuit protection).

Throughout the development stage, PIC investigated and implemented countermeasures for the perceived problems with the IC chip. For example, PIC began to investigate adding an external protective circuit and improving the amplifiers' DC-to-DC power supply (*i.e.*, PIC considered attempting to prevent an over-current condition through the use of a choke coil). Prototypes that incorporated the choke coil as a possible guard against possible excess current flow were tested. When testing with the choke coil still revealed short circuit failures and thermal events that destroyed the IC chips, PIC decided to add external protective circuits to the positive rails of the prototypes for each

of the five prototype amplifiers. PIC also installed a different type of filter on the higher-powered GM-X572 and GM-X972.

After making these design changes that added several layers of short circuit protective guards, PIC's engineering and Quality Assurance departments conducted further prototype tests with positive results. Accordingly, PIC approved the GM-X572 and GM-X972, along with the other three 2003 GM-X Amplifiers, for mass production. In or about December 2002, Pioneer Manufacturing de Mexico S.A. de C.V ("PMM"), a subsidiary of PIC and an affiliate of the Company, began mass production of the 2003 GM-X Amplifiers, except the GM-X372 which was manufactured by a PIC subcontractor known as GPE Electronics (HK) Limited.

C. February and March 2003: Initial Reports Of Failure Modes and PIC's Responses

In January 2003, PMM detected smoke in one GM-X972 amplifier during production. During February 2003, PMM began to observe failures in additional GM-X972 amplifiers, including smoke and thermal events. PMM believed that the failures were due to a defective component known as subheatsinks. A subheatsink is incorporated into the amplifier to draw away and help dissipate the normal increases in heat during routine operation of the unit.

On February 17, 2003, PMM emailed PIC a video clip PMM had filmed depicting a GM-X972 unit experiencing a thermal event. The video clip depicts a flash of flame across the printed circuit board in an opened amplifier. The thermal event occurred when a short was created between the subheatsink and the IC chips. PMM ran the test three times with the same result each time, and in no case did the amplifiers' fuses open. PIC began investigating the cause of the failure, which it initially suspected to be caused by inadequate insulation between the subheatsink and the IC chip, and which was perceived as a component defect rather than a design issue. PIC did not notify PUSA of these production line failures until after the initial submission to the CPSC -- one of the internal communication breakdowns discovered during the Company's internal investigation.

On February 28, 2003, PUSA notified PIC of a report of scorched printed circuit boards on two returned GM-X972 units. PIC began an investigation of the cause of the damage, focusing first on the subheatsink insulation issue.

On March 4, 2003, Best Buy (which sold only the GM-X372 and GM-X972) notified PUSA that it was experiencing a substantial return/defect rate (approximately 7.3%) with the GM-X972 ("components cooking without fuses popping" and attached photos of scorched PCBs – see Exhibit 3). PUSA, in turn, immediately contacted PIC to

investigate. At about the same time, PIC was notified of at least four 2003 GM-X Amplifiers returned to Pioneer Canada ("POC") due to similar consumer complaints.

On March 6, 2003, PIC suspended all production and shipment of the 2003 GM-X Amplifiers. By this time, approximately 39,000 GM-X Amplifiers had been sold by PUSA to its dealers and distributors.

On March 7, 2003, PUSA suspended sales of the GM-X Amplifiers and shortly thereafter began a voluntary recall campaign to collect and repair/replace all five models. PUSA sent notices to its dealers and distributors, sent notices to its authorized service companies, put notices on Pioneer's website, issued a press release, and ran advertisements in six major national/regional newspapers.

D. The Original Recall Campaign of March/April, 2003, and the CPSC Letter of April 24, 2003

PIC mistakenly believed that the subheatsink-to-IC-chip short circuit was the root cause of the failures. This was apparently based on PIC's review of the PMM video clip and PIC's inspection of the first two returned units that PIC received from PSE, both of which evidenced arcing between the subheatsink and the IC chip. In its own testing of the five models, all models failed.

PIC then received from Best Buy 99 GM-X972 units returned by consumers and began its examination of those units. During its examination, PIC discovered that a large number of the returned units did not show signs of failure consistent with a subheatsink-to-IC-chip short circuit.[4]

PIC then began investigating whether the failures were caused as a result of installing the amplifiers to drive a 2 Ω mono bridge load (a configuration specifically prohibited in the Owner's Manual). PIC began testing amplifiers with a resistor simulating a 2 Ω mono bridge load but did not experience any failures with any model during such tests.

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[4] As part of its investigation, PIC realized that it had been incorrectly performing the speaker wire short circuit test. After correcting its testing protocol, PIC re-tested all five amplifier models and experienced failures with the GM-X972 and GM-X572. PIC, however, did not believe that a short in the speaker wire was the root cause of the failures, especially in light of the difficulty in reconciling the relatively rare occurrence of a speaker wire short (i.e., once speakers are installed, it is extremely uncommon for a short to develop thereafter) with the relatively high rate of returns/failures Best Buy experienced.

PIC then purchased a pair of Pioneer subwoofers and linked them in a 2 Ω mono bridge configuration (*i.e.*, dynamic load testing, not resistive load testing), which PIC refers to as its "big bass" test. PIC connected the bridged subwoofers both to GM-X972 and GM-X572 amplifiers that were unmodified (mass production units -- no external protective circuit on negative rail and no added insulation to subheatsink) and to units that were modified (negative rail protection and subheatsink insulation added to mass production unit). PIC had recently developed those two modifications as initial countermeasures, as discussed below. During its testing, PIC used a rotation of approximately seven or eight modified units – each unit was tested multiple times.

Under these testing conditions,[5] both of the modified high-powered models experienced thermal events but failed at a reduced rate. The failures were attributed to oscillation within the ST Micro TDA7293 IC chips, the chip which was used in the GM-X972 and GM-X572. (The other 2003 GM-X Amplifiers used a different IC chip (the TDA 7294) which did not appear to oscillate in testing.) PIC did not experience any failures with any modified model when testing with a 4 Ω mono bridge configuration, *i.e.*, the minimum impedance permitted by the Owner's Manual and installation instructions.

PIC added a protective circuit to the negative rail as a preliminary countermeasure for the GM-X972 and GM-X572.[6] PIC testing results showed that this made an improvement in the unit's handling of excess current flow. Thereafter, PIC made further modification to the GM-X572 and GM-X972 including (1) the addition of diodes to the voltage outputs (preventing the output voltage from swinging above the rail voltage), (2) lowering the protection threshold on the external protective circuit so that the units would barely meet their minimum rated power requirements, and (3) lowering the frequency of the filter in the amplifiers. We now know that none of these modifications addressed the root cause of oscillation affecting the TDA7293, but at the time all the modifications were considered to be reasonable steps to provide interim guarding that would minimize the prospect of a thermal event even when the amplifiers might be improperly configured/installed.

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[5] In addition to the use of Pioneer subwoofers to drive a 2 Ω load, the testing conditions also included the following: (1) volume set at less than max gain, (2) Bass Invaders, "Lost in Bass," track 3, as the song playing on the head unit, and (3) 16 gauge speaker wire.

[6] PIC also added an insulation sheet to the subheatsink as a final countermeasure to fully address the subheatsink-to-IC-Chip short circuit issue. This countermeasure was made to all 2003 GM-X Amplifiers and was considered the only modification that needed to be made to the GM-X372, GM-X374, and GM-574 -- unlike the GM-X972 and GM-X572. Shortly thereafter, PUSA began shipping reworked units of the GM-X372, GM-X374, and GM-X574 to dealers and distributors, and ultimately to consumers.

With all of the modifications, there were no failures during the "big bass" test for either of the two models during PIC's testing on or about April 14, 2003. Nonetheless, PIC remained concerned about the possible affects of improper installation and, after learning that a competitor used a caution card regarding a low impedance configuration, PIC recommended and implemented the inclusion of its own caution card with the two higher- powered models warning against the previously prohibited use of low impedance speakers (*i.e.*, 2 Ω mono bridge or lower).

PIC began building final prototypes of the two reworked models, which were tested by PIC's Quality Assurance ("QA") department between April 16, 2003 and April 22, 2003. During QA's subsequent testing of the final prototypes for the two reworked models, QA observed at least four failures under more extreme test conditions than those used by the PIC engineering department.[7] PIC, however, did not share this information,[8] due to an internal communication and process breakdown.

Shortly thereafter, the Company began shipping the reworked units of the GM-X572 and GM-X972 to dealers and distributors, and ultimately to consumers. No further tests appear to have been conducted on the two models until late June 2003.

E. Consumer Reports of Failures In Reworked Amplifiers, Leading to the Decision To Conduct A Full Recall

On June 26, 2003, Best Buy notified PUSA that consumers were experiencing thermal events with *reworked* GM-X972 amplifiers. The next day, PUSA stopped selling all five GM-X Amplifiers until further investigation could be completed.

PIC continued to believe that the problem with the amplifiers was directly related to the oscillation of the IC chip that was observed in the TDA7293 (used in the GM-X972

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[7] The testing environment used by QA during its testing of the final reworked prototypes of the GM-X972 can be characterized as more extreme than the speaker wire short circuit test and the "big bass" test used by PIC's design engineers. For example, during the QA testing, a 1 Ω load was used and volume/gain was set to maximum levels.

[8] On April 24, 2003, PUSA filed a report to the U.S. Consumer Product Safety Commission ("CPSC") regarding the Original Recall Campaign. In the report, PUSA stated, "[I]n order to prevent similar occurrences in the future, PMM and GPE [manufacturer in China for GM-X372] are both currently manufacturing all GM-X Series Amplifier components . . . with upgraded/modified specifications."

and GM-X572) but had not been observed in the TDA7294 (used in the GM-X372, GM-X374, and GM-X574).

PIC began its testing to confirm that Pioneer could resume sales of the GM-X372, GM-X374, and GM-X574 models. PIC expanded its "big bass" test by (1) including not only Pioneer subwoofers but also Sony subwoofers, and (2) increasing the volume/gain to high or maximum levels. The Sony X-Plode subwoofers were selected as the non-Pioneer subwoofer that was least compatible with a Pioneer amplifier, *i.e.*, one that was most likely to create a problem or failure in installation or operation. On July 2, 2003, applying the expanded "big bass" test and the speaker wire short circuit test, PIC observed no failures with the four GM-X372 units tested and with the four GM-X374 units tested, but observed a failure (but without a thermal event) with one of the four GM-X574 units when the "big bass" test was applied. A copy of those tests results are attached as Exhibit 4 with the mailed original of this Report. Based on PIC's findings, PUSA begin re-selling the GM-X372 and GM-X374.

PIC was concerned that a model with the TDA7294 IC chip had failed and developed a more extreme big bass test which could be called a "super big bass" test (with increased gain and reduced speaker wire gauge). On July 7, 2003, PIC applied the "super big bass" test to the GM-X372 and observed all five of the tested units fail but with no thermal event. A copy of those test results are attached as Exhibit 5 with the mailed original of this Report. It was concluded that this failure did not present a safety issue because (1) the failure mode did not involve a safety risk – no fire, excessive heat, or excessive smoke (the only indication of failure was a slight wisp of smoke), (2) the failure mode involved an extremely unlikely use of 11-gauge speaker wire and an equally unlikely circumstance of speaker misinstallation given that the GM-X372 (like the GM-X374) is a lower powered amplifier and ill-suited for the 2 Ω mono bridge configuration (and as noted above the 2 Ω mono bridge configuration is specifically prohibited in the Owner's Manual), (3) after failing, the units were inoperable and therefore did present a potential future safety risk, (4) the GM-X372 (like the GM-X374) had no reports of failure in the field, and (5) a special caution card could be inserted into boxes of the GM-X372 and GM-X374 warning against speaker misinstallation. Over the following two days, PIC verified the safety of the GM-X372 and GM-X374 through further testing using the "super big bass" test with volume/gain set between half and maximum levels. These tests did not reveal any failures with either model. A copy of those tests results are attached as Exhibit 6 with the mailed original of this Report.

PIC continues to investigate the root cause of the failure of the GM-X972, GM-X572 and GM-X574 when installed in the 2 Ω bridge configuration. As set forth above, the Company's current investigation shows that the output FETs within the IC chip exceed their electrical power dissipation capacity and fail. We believe that when this

occurs, depending on the power output of the unit and the electrical current draw under extreme test conditions, the FET failure destroys the chip, creates a thermal event in the DC-to-DC converter FETs, overheats that portion of the printed circuit board and the nearby resistors, and in some instances has resulted in the event of a flash of flame across the surface of the circuit board for up to five seconds at which point the FET failure is complete and the unit de-powers.

On or about July 9, 2003, PUSA began a second voluntary recall campaign involving the GM-X572, GM-X574, GM-X972, and also the GM-D500M (discussed below). The second recall campaign, similar to the first, involved notices to PUSA's dealers and distributors, notices to PUSA's authorized service companies, notices on PUSA's website, a press release, and two identical but separate recall advertisements in 12 major national/regional newspapers ten days apart, dated July 10 and July 22, 2003. As a part of its recall campaign, PUSA decided to discontinue all four amplifier models at issue (GM-X972, GM-X572, GM-X574, and GM-D500M) and offer replacement amplifiers (GM-X372 or GM-X374) or a full refund to its dealers and distributors as well as to consumers.

At the time of the second recall, approximately 36,000 units of the four models at issue had been sold by PUSA to its dealers and distributors (net of returns associated with the original recall campaign).

F. Development History And The New Design for The Digital GM-D500M Amplifier Using ST Micro Chip

The GM-D500M represented PIC's first attempt to manufacture a digital aftermarket amplifier. The GM-X Amplifiers (analog) and the GM-D500M (digital), both have a fire-resistant printed circuit board and a fire-resistant steel external case, but each has distinct designs and components. One primary difference between the two is that the GM-D500M -- which uses a TDA7570 IC chip manufactured by ST Micro -- has discreet output FETs, whereas the output FETs of the 2003 GM-X Amplifiers are incorporated into the TDA7293/4 IC chips.

When PIC tested the first prototype, it observed problems with distortion, noise, EMC, and power output (the unit could not achieve rated power). PIC also observed during its testing of the TDA7570 that the chip's advertised "over-current protection" feature was not limiting current, as it was designed to do, but rather was stopping all current (*i.e.*, "short circuit protection"). PIC reported this issue to ST Micro, which recommended adding a current sensing resistor to the prototypes so that the chip would function in accordance with its specifications. The current sensing resistor acted to limit,

but not shut down, the flow of current during a short circuit. PIC was concerned that the lack of short circuit protection would leave the amplifier's output FETs vulnerable to damage in the event of a short circuit. PIC nonetheless implemented this modification to the second GM-D500M prototypes.

During the later testing of prototypes, PIC experienced a failure during the speaker wire short circuit test. At that time, PIC did not pursue the issue further because the project was delayed for various reasons.

When PIC resumed work on the GM-D500M, PIC focused on certain EMC problems it had encountered during the testing of the second prototype. The EMC problems were causing the amplifiers to improperly intrude onto the U.S. FM bandwidth. Unfortunately, because of the focus on the EMC problems, the speaker wire short issue was not reconsidered.

In about December 2002, just as mass production of the GM-D500M was about to commence, PIC observed a failure on the production line. PIC then conducted additional testing and experienced failures (smoke). PIC believed that the failures were due to the lack of short circuit protection in the amplifiers, but that in the event of a failure the fuse would blow. PIC did not recognize the risk of thermal events if the amplifier were powered back on *after* the amplifier's blown fuses were replaced. If PIC had recognized this safety risk at the time, it would never have released the product to the market.

In or about January 2003, PIC began mass production of the GM-D500M. PUSA immediately began selling the amplifiers to dealers and distributors, and ultimately consumers.

On or about February 12, 2003, PIC observed two failures of the GM-D500M on the production line. PIC observed smoke coming from at least two units when the units were tested at rated power. PIC powered the units off immediately; no thermal events were observed. PIC believed that the cause of these failures was defective FET components. PIC based its belief on the fact that it replaced the FETs on several failed units and thereafter observed no problems with the units. PIC hypothesized that ST Micro (the FET manufacturer) had provided FETs that were being damaged when the rail voltage of the amplifier was running at only 58V, for example, even though the FETs were rated for 60V. PIC quarantined the apparently defective FETs and contacted ST Micro to test the parts. ST Micro did not respond for at least two weeks. PIC, using what it believed were non-defective FETs, resumed mass production of the GM-D500M.

A few days after resuming mass production, PIC again observed failures of the GM-D500M on the production line. PIC stopped production of the amplifiers on or

about February 18, 2003, and never resumed production. By that time, approximately 974 of the amplifiers had been sold to PUSA's dealers and distributors.

PIC then received ST Micro's response to its inquiry regarding the allegedly defective FETs. ST Micro had tested the FETs and concluded that they were within specifications and not defective. PIC accordingly shifted the focus of its investigation to other possible root causes.

PIC identified at least two other potential root causes of the failures: (1) a speaker wire short (due to the unresolved pre-mass-production failure), and (2) possible product abuse (*i.e.*, 1 Ω speaker load). Both potential root causes appear to implicate a Pioneer process breakdown. With respect to the first potential root cause, PIC experienced an amplifier failure during the speaker wire short circuit test result *prior* to the mass production of the GM-D500M but believed that there was no potential safety issue because the fuse would blow. With respect to the second potential root cause, the Owner's Manual specifically, although mistakenly, allows for a 1 Ω load. An exemplar Owner's Manual for the GM-D500M is enclosed as Exhibit 7 with the mailed original of this Report.

Due to an internal communication breakdown, it was not until mid-March 2003 (*after* the initial recall of the 2003 GM-X Amplifiers had already commenced) that PIC notified PUSA of the possibility that a thermal event could also be associated with the GM-D500M. PIC stated that when the amplifier's speaker output was short circuited or a 1 Ω resistive load was connected to the amplifier, the amplifier would blow a fuse (because the current protection feature was not working) and the output FETs would become permanently damaged. A copy of PIC's tests results are attached as Exhibit 8 with the mailed original of this Report. PIC, by that time, had learned that if the user replaced the amplifier's fuses, a thermal event similar to the GM-X972 could result. PIC advised PUSA of this and suspended shipment of any additional GM-D500M units.

Consequently, on or around April 14, 2003, PUSA discontinued the GM-D500M and requested that its dealers and distributors return all GM-D500M units in their possession. PUSA believed that once a unit was properly installed, it would continue to function without incident – in other words, any failure (due to speaker wire short or speaker load/impedance) would occur, if at all, upon initial power up. As a result, PUSA did not believe it was necessary to directly ask consumers to return this model, particularly because approximately 95% of the amplifiers that had been manufactured and shipped were sold to dealers and distributors in January 2003 and, therefore, by April 2003, would have been sold-through to consumers, installed into vehicles, and would have failed only upon initial power up if they had been improperly installed. PUSA's

subsequent efforts to collect the amplifiers from dealers and distributors yielded approximately 88 returned units of the 974 originally sold.

When the Company began its late June 2003 internal investigation of the 2003 GM-X Amplifiers (discussed earlier in this Report), it reconsidered its earlier decision not to notify consumers directly regarding the GM-D500M. Out of an abundance of caution, the Company included the GM-D500M in its second recall campaign, which began on or about July 9, 2003.

V. Identifying the Remedy

In its second recall campaign, the Company elected to a conduct a voluntary full recall with a refund or exchange option for amplifier models GM-X972, GM-X572, GM-X574, and GM-D500M. All four of these models have been discontinued; the GM-X models earlier this July and as set forth above, the GM-D500M was discontinued in April. PUSA is offering the vigorously re-tested but lower powered amplifiers (GM-X372 or GM-X374) as replacements.[9] or a full refund to its dealers and distributors as well as to consumers.

In addition, PIC prepared an updated special caution card in color to be included in the original packaging of every GM-X372 and GM-X374 amplifier shipped on or after July 17, 2003. A copy of this special caution card is attached to the mailed original of this report as Exhibit 9.

VI. Identifying the Recall Schedule

Official notification to the public and to Pioneer distributors, service facilities, and authorized retailers began on July 9, 2003. The Company posted notices on PUSA's website,[10] issued a press release, and published two separate advertisements in 12 major national/regional newspapers that ran on July 10, 2003 and July 22, 2003. The Company will be supplementing this publicity campaign with requests to Pioneer authorized retailers for customer names and addresses, if available, so that we can send letters directly to identifiable end consumers of each of the four recalled amplifier models.

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[9] The GM-X372 and GM-X374 amplifiers being offered as replacements have, of course, been modified to include the upgraded subbeatsink insulation pursuant to the original recall of the 2003 GM-X Amplifiers.

[10] PUSA's website now includes notice regarding the continued recall and upgrading of the GM-X372 and GM-X374 with respect to the subbeatsink problem, which was the subject of the original recall campaign.

VII. Furnishing Recall Communications and Responding to NHTSA's Request for More Detail on Customer Identification and Notification.

Enclosed with the mailed original of this Report collectively as Exhibit 10 are copies of the Website notice, press release, and advertisements published on or about July 9, 2003 in the second recall campaign. We had previously provided these to NHTSA under cover of our letter dated July 14, 2003.

Your initial acknowledgment fax sheet dated June 23, 2003 also requested copies of notification documents from the original recall campaign. Enclosed with the mailed original of this Report collectively as Exhibit 11 are copies of the Website notice, press release, and advertisements published in March 2003 as a part of the original recall campaign. We had previously provided these to NHTSA under cover of our letter dated July 14, 2003.

Sincerely,

Hiroaki Matsubara
Mobile Entertainment Division
President, Pioneer Electronics (USA) Inc.

Quarterly Report Information

Report Date: July 30, 2003 **Calendar Quarter**: 2nd

Safety Recall Quarterly Report from April 24, 2003 to July 24, 2003

Manufacturer: Pioneer Electronics (USA) Inc. ("PUSA") is the corporate entity responsible for the recall campaigns and is the entity to be contacted for same. The actual manufacturer of the GM-X374, GM-X572, GM-X574, and GM-X972 amplifier models is Pioneer Manufacturing de Mexico S.A. de C.V. The manufacturer of the GM-X372 is GPE Electronics (HK) Limited, a subcontractor of PIC. The manufacturer of the GM-D500M is PIC.

Report Author: Hiroaki Matsubara, President of PUSA's Mobile Entertainment Division.

Phone No.: (213) 746-6337.

Recall Subject: Pioneer 2003 GM-Series Aftermarket Car Amplifier Models GM-X972, GM-X574, GM-X572 and GM-D500M

1. **NHTSA Safety Recall Campaign No.** 03E-035

2. **Notification Dates**

    a) **The date notification to purchasers began**: July 7, 2003

    b) **The date notification of purchasers was completed**: Ongoing, in light of the second recall campaign.

3. **Items of Equipment Involved**: approx. 36,000

    a) **Number of Items Returned from Inventory or Remedied Prior to Sale**: approx. 18,000

4. **Total Number of Items Inspected and Remedied**: Not applicable – all units discontinued.

    a) **Total Number Inspected and Not Requiring Remedy**: None.

5. **Items Determined to be Unreachable**: Unknown at this time, in light of second recall campaign.

Total Number Exported: Not applicable – PUSA does not export; however, PIC exports GM-Series Amplifiers to foreign resellers and has notified the resellers in those foreign markets.

Total Number Stolen: None known.

Total Number Scrapped: Unknown at this time.

Total Number Unable to Notify: Unknown at this time.

Total Number Otherwise Unreachable: Unknown at this time.

Describe Other: Unknown at this time.