May 27, 2011

Mr. Michael Leaon
Mr. Harinder Singh
California Energy Commission
1516 Ninth Street
Sacramento, CA 95814

Subject: 2010 Rulemaking Proceeding Phase II on Appliance Efficiency Regulations
(Docket # 09-AAER-2)

Dear Messrs. Leaon and Singh:

Recently the California Energy Commission (CEC) held a third workshop on the topic of energy efficiency requirements for Battery Charging Systems. The CEC provided this workshop as an opportunity for all stakeholders to discuss important issues with the proposals that have been made.

As a manufacturer of specialized and sophisticated non-consumer Battery Charging Systems, Motorola Solutions, Inc. (MSI) was pleased to attend the workshop and appreciates the opportunity to further comment on the issues discussed there. As small, non-consumer Battery Charging Systems are complex and vary greatly in functions and features, we understand that appropriate and effective regulation is a complex topic, and we look forward to a continuing dialogue regarding energy efficiency for Battery Charging Systems. In this letter, we offer comments on several issues related to the current proposal.

1.0 There have been positive changes to the scope and proposed test method

Motorola Solutions, Inc. applauds the decision of the CEC to remove Battery Analyzers from the scope of the proposed regulation. While these products do have the capability to charge batteries, their fundamental purpose is as test equipment and it would not be appropriate to regulate them in the same was as a true Battery Charging System. We also agree that removing the power factor requirements from the proposal for all small battery chargers is appropriate for a variety of technical reasons as outlined in comments we submitted previously. Furthermore, we are not opposed to the addition of a certification requirement, as it provides a mechanism that would facilitate the method we have proposed for turning off non-battery charging functionality during testing (see section 4.0 below).

In addition, Motorola Solutions appreciates the CEC's proposed change to the test method for Multi-Unit Chargers, such that these units may be tested with a battery in each port, and with increased power and energy allowances proportional to the number of ports. This will definitely reduce testing costs and burden. Motorola Solutions would like to suggest one further change regarding chargers that can test more than one type of battery, and ask that the CEC consider requiring testing only with the highest capacity battery that can be used with a given charger. This will further reduce the testing burden to a more manageable size.

A small number of our chargers may now pass with minor modifications. However, the positive changes have only moved our ability to comply with the great majority of our products, from nearly impossible to feasible, with significant re-design and re-certification still necessary. We can accomplish that re-design and re-certify given sufficient time, but require more exemption time than currently offered. We will elaborate below.

2.0 The economic analysis used as a basis for the cost-benefit analysis of small non-consumer products contains significant errors

Motorola Solutions, Inc. has carefully reviewed the original CASE report and the subsequent CEC model regarding cost-benefit analyses of the proposed regulation. MSI does not dispute the cost-benefit analysis in the CASE report or the CEC model that shows significant savings will be accrued based on energy efficiency improvements that would be made to consumer products under the current proposal. However, the "small non-consumer" battery charger systems that are made by MSI are quite different from these consumer products. They have significantly more functionality and features, they are regulated by multiple agencies for safety issues, Electro-magnetic interference issues, etc., they have a much longer product life, and they are quite expensive. In our previously submitted comments dated March 15, 2011, MSI presented data regarding the true costs of compliance for these types of complex, non-consumer Battery Charging Systems. In summary, the data we have presented shows that rather than saving money for the California customer of our products, the proposed regulation will actually cost them money, as our total cost is increased and the electricity savings does not offset our total costs. This is in direct violation of the requirements of the Warren-Alquist Act, which states CEC appliance efficiency standards shall not result in any additional cost to the consumer. Motorola Solutions, Inc. would like to highlight that this would indicate that this regulation should not move forward for these products.

Table 1 Costs and Savings per Unit Associated with Draft Staff Report Proposal

Product	Component Costs (from CEC model)	Regulatory re-certificationcosts (our calculation*)	Engineering costs (our calculation*)	Total Costs	Total Electricity Savings (from CEC model)	Net Savings (or<cost>)
Handheld Barcode Scanners	$0.50	$14.00	$46.00	$60.50	$19.87	<$40.63>
Two-way Radios	$0.50	$3.21	$21.42	$25.13	$8.75	<$16.38>

* Based on actual product volumes as elaborated below

3.0 Battery chemistries

Motorola Solutions, Inc. continues to have concerns with the treatment of nickel-based batteries in the proposed regulation. While it is true that nickel-based batteries are inherently less energy efficient during charging, they have other significant advantages, such as longer battery life (up to double in some cases, thus reducing battery waste) and superior performance in cold temperatures (see Table 2).

Table 2 Cell Capacity % vs Discharge Temperature

Temperature (°C)	NiCd typical cell (0.2C discharge)	NiMH Cell formulated for cold temperature performance (0.2C discharge)	Li-Ion typical cell (0.2C discharge)	Li-Ion Cell formulated for cold temperature operation (5/5/90 discharge*)
+25	100	100	100	100
0	80	85	50	50
-10	60	75	30	30
-20	30	50	~0	20
-30	2	10	~0	10

*Per the manufacturer, this battery tested using 5% transmit/5% receive/90% standby for the duty cycle which yields a discharge rate similar to 0.2 C

In the response to comment 15, the CEC draft Staff Report states "It is feasible to meet the proposed regulations with any battery chemistry." As noted in the Black and Decker presentation at the recent CEC workshop on May 19, 2011, this is not true for all battery chemistries at higher energy levels. And while this may be technically true for the lower energy batteries typically found in simple consumer products with long battery charge cycles, it is not the case for battery charging systems for non-consumer products with higher energy batteries, advanced functions, and rapid charge cycles. Of particular concern are the nickel-based batteries that are heavily used in mission-critical applications where superior performance across all temperatures is required. While nickel-based batteries have the aforementioned advantages, they also have shortcomings. Nickel batteries naturally have higher loss during recharge. Note figures 1 and 2 below which show the difference in charging efficiency between a typical NiMH battery used by MSI and a typical Lithium Ion battery used by MSI.

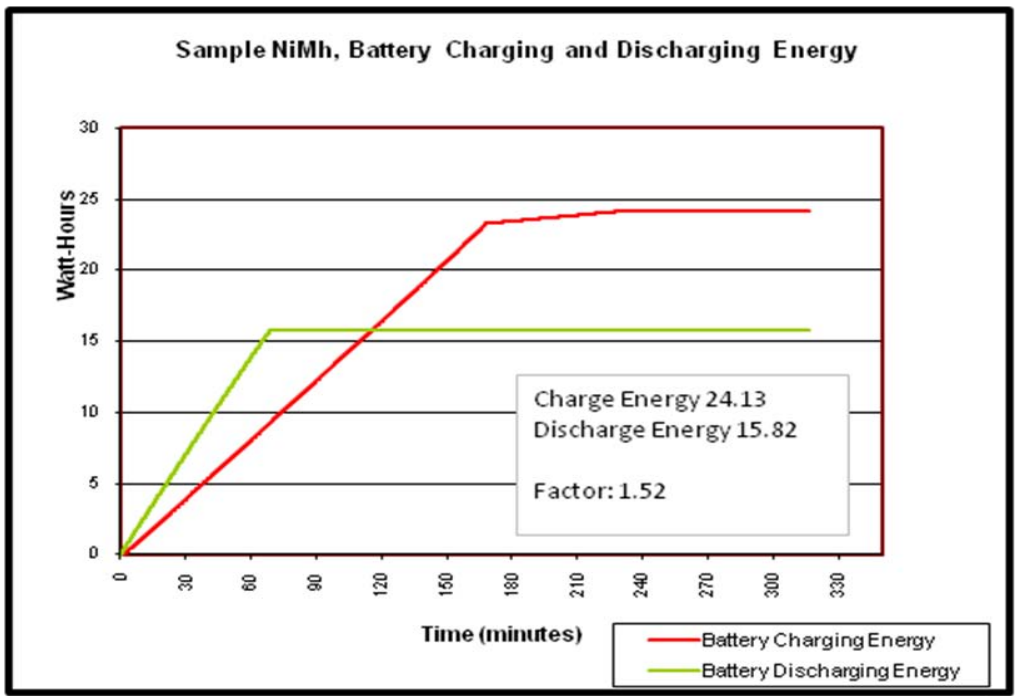

Figure 1 Efficiency of NiMH battery charge cycle
Discharge 2A to 6V
Capacity 2302mAh

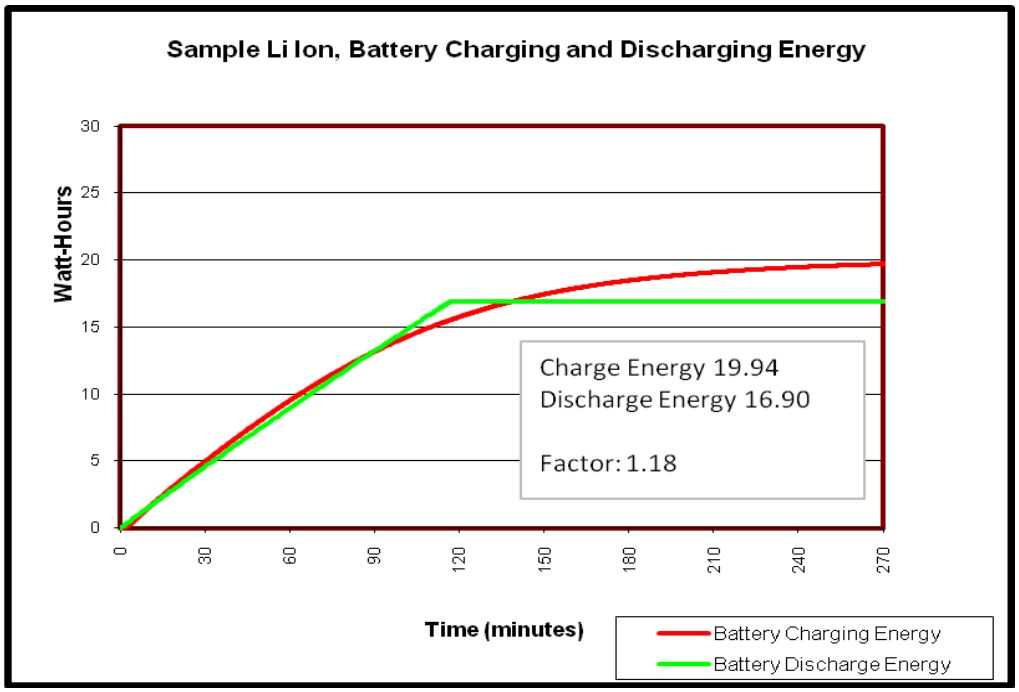

Figure 2 Efficiency of Lithium Ion battery charge cycle
Discharge 1.225A to 6V
Capacity 2385mAh

Not accounting for this fundamental difference in the efficiency requirements places significant additional burden on the charging solution for Nickel chemistry batteries. Excluding for a moment consideration of the No Battery and Maintenance Mode requirements:

For NiMH battery:

$$ChargeEnergyNiMH = 24.13$$
$$DischargeEnergyNiMH = 15.82$$

$$ChargerEfficiencyNiMH = \frac{ChargeEnergyNiMH}{1.6 * DischargeEnergyNiMH} = 0.953 = 95.3\%$$

For LiIon battery:

$$ChargeEnergyLiIon = 19.94$$
$$DischargeEnergyLiIon = 16.90$$

$$ChargerEfficiencyLiIon = \frac{ChargeEnergyLiIon}{1.6 * DischargeEnergyLiIon} = 0.737 = 73.7\%$$

As demonstrated by the graphs and calculations above, given the lower charging efficiency of NiMH batteries, the battery charging system for these batteries must be 95% efficient in order to meet the proposed requirements, whereas the battery charging system for the more efficient LiIon battery only needs to be 74% efficient.

If we agree that the LiIon system, with a charge factor of 1.18, is representative of the technology, then the margin of (1.6-1.18)=0.42 in the current proposed regulation would seem to be acceptable. A similar margin allowed to chargers of nickel-based batteries would yield a charge factor of (1.52+0.42)=1.94. Therefore, Motorola Solutions, Inc. proposes the use of (12+1.9Eb)xN as the limit on 24-hour charge and maintenance energy for nickel-based batteries.

In its current form, the CEC proposal, instead of being neutral, is far more restrictive of nickel batteries. This will require these types of chargers to undergo more extensive design changes which will result in much higher costs and cycle times to get compliant designs to the market (if compliance is even achievable). This would mean increased selling prices to mission critical customers, and could result in product unavailability or shortages. It would be far more appropriate to differentiate the proposed energy efficiency requirements based on battery chemistry, or alternatively to raise the proposed limits for each mode across the board.

4.0 The proposed limits on power consumption are too low to account for the additional functionality of advanced Battery Charging Systems

The proposed limits for power consumption consider only the energy needed to charge the battery, and do not account for any functions beyond that which are performed by advanced non-consumer BCS. Most of these functions are integrated into the system in such a way that they cannot be turned off by the user, and so would remain on during tests conducted per the CEC test method. These additional functions include:

a) indicators (LEDs, displays, etc.)
b) fan for multi-port chargers (typically always on);
c) communications between the charger and the batteries;
d) communications between the charger and other equipment;

These functions are not related to battery charging, and MSI feels strongly that it is not appropriate to include their power consumption in a calculation for energy efficiency of the battery charging process.

The proposed test method allows for some functions to be turned off during testing (see Part I, section II(D));
"Any optional functions controlled by the user and not associated with the battery charging process (i.e., a radio integrated into a cordless tool charger) shall be switched off."

MSI proposes that the regulation allow **all** non-battery charging functions to be turned off when the product is tested, including those that cannot be controlled by the user (but not including safety circuitry). We also propose that any manufacturer who chooses to do this be required to include explicit documentation of changes made in the test report to allow for understanding and replication of results, as well as conduct an additional test to demonstrate only non-battery charging functions were disabled. A comparison of battery discharge energies before and after modification to values within 5% will serve as proof that the charging functions themselves were not modified by this process.

Failure to account for the power used by additional functions will discourage device convergence and result in manufacturers making two separate products, a simple battery charger plus another device performing the additional functions, in order to meet the regulation's requirements and our customer's needs. This will obviously result in an overall increase in the amount of energy used to perform these functions, not to mention additional resources needed to manufacture the separate products, additional costs to customers, and the additional electronic waste which would be generated at end-of-life. Clearly this scenario is contrary to the CEC's goals of conserving energy and should be avoided.

5.0 The proposed timeline is too short; the annual sales volumes used for many non-consumer products are too large

Beyond the costly and unreasonable requirements already discussed, and the negative cost-benefit analysis, the proposed timeline for implementing what would be a massive re-design of Motorola Solutions complete product line is simply too short. Allowing only 24 months from date of publication to effective date does not allow sufficient time for products to be re-designed, validated/tested, and certified by Certification Bodies.

As Motorola Solutions has noted previously, the types of non-consumer products mentioned above are quite different from consumer products and we feel it is appropriate for the regulation to employ a tiered approach to compliance as was done previously with External Power Supplies. The justification for a longer implementation timeframe is based on several factors unique to these products: the long design cycle times, long product life in the field, the high costs of these specialized products, and most importantly, the relatively very small volumes of these specialized products which are put on the market each year in California. Per the Draft Staff Report, the proposed regulation would save approximately 360 GWh in the first year (Table B-6). Also per the Draft Staff Report, the energy savings in the product category of two-way radios would be approximately 0.17 GWh in the first year, or 0.05% of the regulation's total projected savings. Therefore, delaying the implementation of these savings for an additional 2 to 3 years has very little impact on the overall goal of the regulation, but stands to yield significant benefit to the California customer in terms of product availability and cost. Likewise, products in the category of <u>cordless</u> barcode scanners will yield approximately 0.45 GWh in the first year, or 0.13% of the total projected savings (you will recall MSI's contention that the numbers in the CASE and Draft Staff Report for "handheld barcode scanners" include both corded and cordless types, and that the corded scanners only make up approximately 11% of the market, so the 4.06 GWh number presented in the Draft Staff Report for these products was adjusted accordingly). Again, these numbers show that there is a relatively very small impact to the overall energy savings goal, but a large benefit to the California customers of these products if the timeline for compliance of these products is extended. In order to prevent product shortages in California and minimize cost impacts to California customers, Motorola Solutions, Inc. proposes that small, non-consumer products be allowed 5 years to comply with the proposed regulation's requirements.

In summary, Motorola Solutions, Inc. appreciates the opportunity to submit comments on the current proposed amendments. We believe the current proposal is technically challenging even with the modifications proposed to date and would result in net costs to the California consumer along with product shortages for our customers, including mission critical customers (e.g. police and fire agencies). We feel we have clearly demonstrated the negative impact of the proposed regulation in its current form, and our current recommendation would be that the proposed regulation does not move forward for this reason. We would be happy to continue our dialogue with the CEC staff, and look forward to the opportunity to continue to collaborate on the important topic of energy efficiency of Battery Charging Systems.

Sincerely,

Don G. Bartell
Motorola Solutions, Inc.
Senior Director, Corporate Sustainability