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BY MAIL

Steven Cliff, Director
National Highway Traffic Safety Administration
1200 New Jersey Avenue, SE
Washington, DC 20590

Re: Petition to Issue Non-Compliance Order for the 2021 Tesla Model 3 For Non-Compliant Vehicle Lights

Dear Steven Cliff,

Pursuant to CFR Title 49, Subtitle B, Chapter V, Part 552, Subpart A Petitions for Rulemaking, Defect, and Non-Compliance Orders, the Soft Lights Foundation hereby submits this petition requesting that NHTSA issue an order of non-compliance for the 2021 Tesla Model 3 for failing to meet federal safety regulations for vehicle lighting. The petition is contained in the following pages.

Sincerely,

Mark Baker

Mark Baker
President
Soft Lights Foundation
mbaker@softlights.org

Petition for Order of Non-Compliance for 2021 Tesla Model 3 for Non-Compliant Vehicle Lights

I. Introduction

In 1966, Congress passed the National Traffic and Motor Vehicle Safety Act which led to the creation of the National Highway Traffic Safety Administration.[1] The Federal Motor Vehicle Safety Standards under Section 103 of the Act are codified as CFR Title 49, Subtitle B, Chapter V, Part 571.

The 2021 Tesla Model 3 LED headlamps fail to comply with FMVSS Standard 108. LED headlights emit light from an electronic device and from a flat surface chip which require safety regulations as directed by Congress. Despite Congress' directive, neither the FDA nor NHTSA have developed such safety regulations for LED products. Tesla failed to follow the required regulatory process for requesting authorization to use LED lighting technology, no safety regulations for LED headlamps were ever developed, and Tesla never received NHTSA authorization to use LED headlamps.

The safety of the public is at risk due to the characteristics of LED headlamps and consumers who have purchased the 2021 Tesla Model 3 have been harmed because of their purchase of a vehicle that does not meet federal safety regulations.

II. Radiation Control of Health and Safety Act of 1968

In 1968, Congress passed the Radiation Control for Health and Safety Act which directed the Food and Drug Administration to regulate electronic products and the electromagnetic radiation emitted by those products, including visible light. The FDA issued Title 21, Part I, Subchapter J, Part 1040 in the Code of Federal Regulations which is titled Performance Standards for Light-Emitting Products. The FDA has issued 21 CFR Part 1040.10 Laser products., Part 1040.20 Sunlamp products and ultraviolet lamps intended for use in sunlamp products., and Part 1040.30 High-intensity mercury vapor discharge lamps.

In 2018, the FDA posted the statement on the FDA's website, "*LEDs (Light Emitting Diodes) are different from laser diodes and are not subject to the Federal laser product performance standard.*"[2] Thus, LED products are unregulated. This lack of regulation of LEDs violates Congress' mandate in the

[1] https://www.govinfo.gov/content/pkg/STATUTE-80/pdf/STATUTE-80-Pg718.pdf

[2] https://www.fda.gov/radiation-emitting-products/home-business-and-entertainment-products/laser-products-and-instruments

1968 Radiation Control for Health and Safety Act to regulate electromagnetic radiation.

Congress has long understood that light from an electronic device is different than light from a burning filament or gas discharge. An automaker cannot justifiably claim that LED light is no different than tungsten filament light or that existing regulations for tungsten filament or gas discharge light are applicable to light from an electronic device. Congress has made clear that light from electronic devices creates specific hazards that cannot be ignored and must receive regulatory approval.

III. Light Emitting Diodes

There are two types of light sources: spherical/point sources and flat-surface sources.

Spherical/Point source: A spherical/point source emits light from a curved surface which results in spatially uniform energy, and which can be modeled as a mathematical point. Brightness is measured with luminous intensity in candela. Examples include the sun, a candle, an incandescent light bulb, fluorescent, High-Pressure Sodium, tungsten filament, and tungsten filament with halogen gas.

Flat-surface source: A flat-surface source emits light from a non-curved, flat surface which results in spatially non-uniform energy, and which creates a Lambertian mathematical shape. Brightness is measured with luminance in nits (candela per square meter). An example is a Light Emitting Diode.

Cellular organisms and viruses have evolved with the uniform energy of spherical/point source light. The introduction of non-uniform energy from flat-surface source devices has created new type of light. For humans and other biological systems, this surface source LED light is a low-quality light because of its spatial non-uniformity, piecewise spectral power distribution, and square wave flicker. The diagram below shows a comparison of the spatial, spectral, and temporal properties of spherical/point source versus flat-surface source light.

Incandescent vs. Light Emitting Diode (LED)

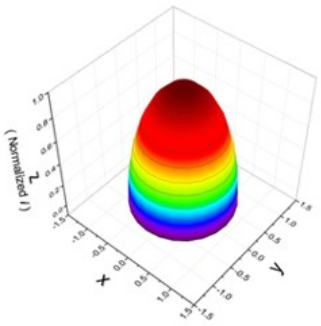
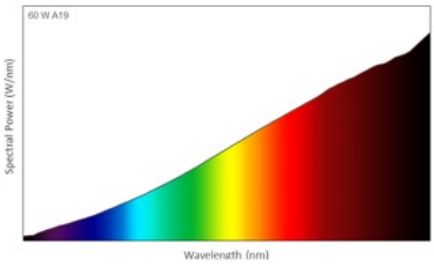
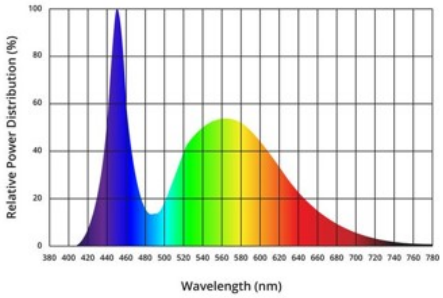
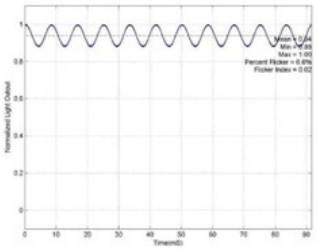
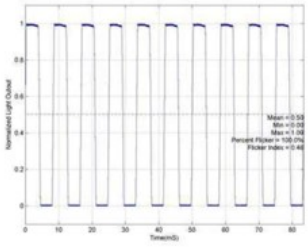
	High Quality Light Incandescent	Low Quality Light LED
Spatial		
	Uniform Luminance	Non-Uniform Luminance
Spectral		
	Low Blue Continuously Increasing	Blue Spike Piecewise
Temporal		
	Analog Sine Wave	Digital Square Wave

Figure 1 - Incandescent vs. LED

The Institute of Electrical and Electronics Engineers has published a peer-reviewed article by Dr. Nisa Khan that details the calculus mathematics used to describe the Lambertian shape of a flat-surface source.[3] Figure 2 from the IEEE article shows how light from a flat surface LED chip does not produce spatially uniform energy. This view is a 2D cross-section of 3D space.

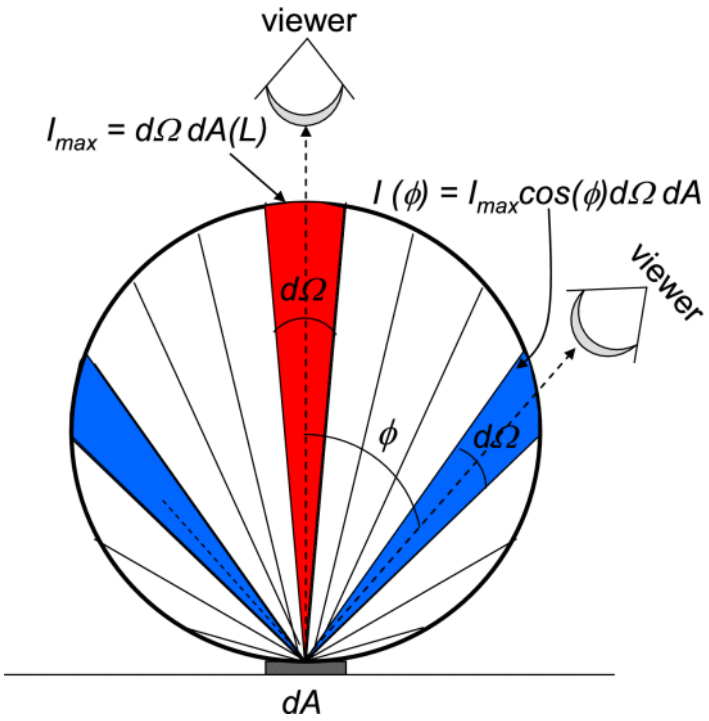


Figure 2 - Lambert's Cosine Law

This mathematical proof that LED light is spatially non-uniform is of utmost importance for the regulation of LED light. At this time, no government agency has developed regulations for these LED products which emit different energies and characteristics at every point in 3D space. Previous formulas, calculations, and regulations that assumed uniform luminance cannot be used with LED light.

IV. Motor Vehicle Safety Act

Section 102(1) of the 1966 Motor Vehicle Safety Act states, "*'Motor Vehicle Safety' means the performance of motor vehicles or motor vehicle equipment in such a manner that the public is protected against unreasonable*

[3] https://ieeexplore.ieee.org/document/8879542

risk of accidents occurring as a result of the design, construction or performance of motor vehicles and is also protected against unreasonable risk of death or injury to persons in the event accidents do occur and includes non-operational safety of such vehicles." The design of a vehicle that uses LED headlights places the public at an unreasonable risk of injury or death and thus vehicles with LED headlamps are unsafe and do not comply with the Motor Vehicle Safety Act of 1966.

Section 103(a) states, "*The Secretary shall establish by order appropriate Federal motor vehicle safety standards. Each such motor vehicle safety standard shall be practicable, shall meet the need for motor vehicle safety, and shall be stated in objective terms.*" For vehicle lighting, these standards are codified as 571.108 Standard No. 108; Lamps, reflective devices, and associated equipment.

Title 49 of the Code of Federal Regulations Part 571.108(S2) Purpose states, "*The purpose of this standard is to reduce traffic accidents and deaths and injuries from traffic accidents, by providing adequate illumination of the roadway, and by enhancing the conspicuity of motor vehicles on public roads so that their presence is perceived and their signals understood, both in daylight and in darkness or other conditions of reduced visibility.*"

571.108(S4) Definitions. "*Filament – means that part of the light source or light emitting element, such as a resistive element, the excited portion of a specific mixture of gasses under pressure, or any part of other energy conversion sources, that generates radiant energy which can be seen.*"

571.108(S5) References to SAE Publications states, "*Each require lamp, reflective device, and item of associated equipment must be designed to conform to the requirements of applicable SAE publications as referenced or subreferenced in this standard.*"

571.108(S10.1.1) "*Each passenger car, multipurpose passenger vehicle, truck and bus must be equipped with a headlighting system conforming to the requirements of Table II and this standard*."

571.108(S14.1.1) "*Each lamp, reflective device, item conspicuity treatment, and item of associated equipment required or permitted by this standard must be designed to conform to all applicable physical test performance requirements specified for it.*"

Table XIX Headlamp Lower Beam Photometry Requirements contains columns for minimum and maximum photometric intensity measured in candela. Here is critical to note that candela, which is the metric for luminous intensity, is used to measure the brightness of spherical/point light sources such as tungsten filament. NHTSA has determined that vehicle headlights should be

bright enough to illuminate the road, but not so bright as to overwhelm an oncoming driver or pedestrian.

However, the light from flat surface LED chips is measured using the luminance metric in candela per square meter, also known as nits. Luminance is a density measurement, and it is necessary to regulate the peak luminance since the light from a flat surface chip has a different luminance at every point in space. It is also necessary to measure the luminance in near field at approximately 1 micrometer from the chip and with precision in the femtometer or picometer scale since LED light is emitted from such a small flat surface.

FMVSS-108 contains no tables for specifying the minimum or maximum peak luminance of an LED headlight system and does not specify or refer to measurement requirements that involve a laboratory setting and precision measurement devices. Thus, a vehicle with an LED headlight system is non-compliant with FMVSS-108 because an LED headlight system cannot meet the requirements of Table XIX and there are no tables in FMVSS-108 that are applicable to an LED light source.

FMVSS-108 is an extensive and highly detailed standard. As can be seen from viewing the entirety of the FMVSS-108 standard, this document specifies minutiae that are not normally found in federal regulations. Therefore, it would defy believability that, with this amount of detail, NHTSA would provide no details needed to regulate LED headlamps and then contend, improbably, that regulations for solid-state, flat surface source lighting such as LEDs are regulated within the FMVSS-108 standard. LEDs require restrictions on spatial non-uniformity, peak luminance, spectral power distribution, and square wave flicker, none of which are mentioned in FMVSS-108. The only reasonable conclusion is that FMVSS-108 applies to spherical/point source lighting systems such as tungsten filament or tungsten/halogen, and that an LED vehicle headlamp system cannot comply with FMVSS-108.

The auto makers are required to self-certify that their vehicles meet FMVSS-108 standards. Since the brightness of the light from a flat surface source must be measured with luminance in nits, and since the precision required to measure this luminance requires a precise laboratory setting, it is not possible for an auto maker to validly claim that an LED headlight system complies with Table XIX. Any attempt to use existing measurement equipment or procedures to measure the headlamp light at the required distance (typically 100 feet), will result in invalid data that cannot be used to certify an LED headlamp system.

V. Consumer Harm

As of August 2022, over 30,000 people have signed a public petition demanding that NHTSA ban or regulate LED headlights because of the danger they pose to the public.[4] This is 6 times more comments than NHTSA has ever received for any vehicle safety issue in the entire history of NHTSA. Clearly, LED headlights are a significant problem.

Figure 3 shows the 2021 Tesla Model 3 LED headlights. The headlights exhibit a sharp blue/white color and the video shows the pulsing square wave flicker. The reason that these LED headlights feel uncomfortable even in a photo is because they do not meet federal safety regulations. NHTSA has no regulations for LED headlamps which set restrictions on luminance, spectral power distribution, and flicker. Tesla's use of non-compliant headlights endangers public safety.

Figure 3 - 2021 Tesla Model 3 LED Headamps[5]

Manufacturers in other industries have recognized that LED light is dangerous. The operator's manual for the Ryobi P705 Flashlight includes the following: "**WARNING: Do not direct the light beam at persons or animals and do not stare into the beam yourself (not even from a distance) Staring into the light beam may result in serious injury or vision loss**." The parenthetical "(not even from a distance)" indicates a high level of danger.

[4] https://www.change.org/p/u-s-dot-ban-blinding-headlights-and-save-lives
[5] https://youtu.be/HbJGRrNhPMA

WARNING:

Do not direct the light beam at persons or animals and do not stare into the light beam yourself (not even from a distance). Staring into the light beam may result in serious injury or vision loss.

One of the characteristics of LED light is that it will affect people at long distances from the source, and the extreme spike of blue wavelength light, as shown in Figure 3 will cause significant, dangerous glare. Numerous research studies have shown that blue wavelength light from LED sources can cause serious eye injury. In addition, the epidemiological data that has been collected over the past several years shows that LED light will trigger epileptic seizures, migraines, panic attacks, anxiety and decreased cognitive functioning.[6]

Figure 4 is a screen capture from a video taken by a driver. The video and screen capture show the extreme glare caused by typical LED headlights.

Figure 4 - Vehicle Headlight[7]

[6] http://www.softlights.org/resources/
[7] https://youtu.be/sQHpikG7UhA

Ultimately, both consumers and insurance companies are harmed by Tesla's use of non-compliant LED headlights. The dangerous glare and the non-uniformity of the light may trigger an accident resulting in property damage, personal injury, or death, and may trigger a seizure, migraine, panic attack, or other negative neurological reaction.

VI. Regulatory Process

The procedure for requesting approval of a rule to allow an amendment to existing safety regulations is described in 49 CFR Part 552. As an example of this process, Toyota Motor Corporation petitioned NHTSA to authorize the use of Adaptive Driving Beam on March 29, 2013.[8] Toyota was assigned docket number NHTSA-2022-0013-0002.

Similarly, Tesla is required to petition NHTSA to authorize the use of LED technology for headlamps. NHTSA would then either reject the petition or would develop standards for LED headlamp technology that would include restrictions on spatial non-uniformity, peak luminance/radiance, absolute spectral power distribution, and square wave flicker. NHTSA would also coordinate with the Food and Drug Administration to develop comfort, health, and safety standards for flat-surface source light to ensure the protection of the public, especially those who are highly sensitive to LED light.

Once the FDA publishes the comfort, health, and safety standards for LED products, and once NHTSA publishes regulations for LED headlamps, only then would a petition from Tesla requesting authorization to use LED technology for headlamp systems be granted.

Since Tesla chose to skip the regulatory process in its entirety, Tesla vehicles using LED technology are non-compliant with federal safety regulations, and Tesla vehicles are subject to recall.

VII. Summary

The 2021 Tesla Model 3 does not meet federal safety regulations specified in 49 CFR 571.108 for the following reasons:

1. Congress has determined that visible light from an electronic device is different than light from a burning filament or gas discharge and that this visible electromagnetic radiation from an electronic product requires special federal regulations.

[8] https://www.regulations.gov/document/NHTSA-2022-0013-0002

2. The FDA has not yet developed the health and safety regulations for LED products, and thus LED headlamps are an unregulated product which have not been deemed safe.
3. NHTSA FMVSS Section 108 is only applicable to spherical/point light sources and specifies intensity minimums and maximums using luminous intensity measured in candela. Only vehicles using spherical/point light sources can be compliant with FMVSS-108.
4. NHTSA has not yet developed the health and safety regulations for surface source LED headlamps and has not specified the necessary restrictions that might make LED headlamps safe. These regulations would include restrictions on spatial non-uniformity, peak luminance, spectral power distribution, and square wave flicker.
5. Tesla failed to petition NHTSA for amendment of existing regulations to allow use of LED technology for headlamps and has not received authorization from NHTSA.
6. LED headlights are dangerous due to the excessive glare, non-uniform luminance, excessive peak luminance, and square wave flicker, putting public health and safety at risk.

VIII. Requested Action

1. Issue Tesla an Order of Non-compliance.

2. Notify the public that LED headlamps do not comply with federal safety regulations.