

**Federal Communications Commission
Office of Engineering and Technology
Laboratory Division**

October 22, 2015

Draft Laboratory Division Publications Report

Title: LED Lighting Products

Short Title: LED Lighting

Reason: Clarification of testing and equipment authorization requirements for LED lighting devices.

Publication: 640677

Keyword/Subject: Testing and emission limits for LED lights

Question:

What rules and approval procedures apply to LED lighting devices?

Answer:

The attachment below [640677 D01 LED LIGHTING v01](#) provides guidance on the applicable limits and approval procedures for LED lighting devices.

Attachment List:

[640677 D01 LED LIGHTING v01](#)

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LED LIGHTING PRODUCTS

INTRODUCTION

Light-emitting diode (LED) lighting products are subject to FCC rules to control potential harmful interference to radiocommunications services.¹ This KDB publication clarifies how the present FCC rules apply to these products, and outlines the manufacturers' responsibilities for controlling interference.

In most cases, LED lighting devices employ either an independent or integrated electronic driver that operates at RF frequencies similar to those used in digital electronic products. As such, LED lighting devices are subject to the Part 15 rules for unintentional radiators, and are subject to the "Verification" equipment authorization procedures, with the associated line-conducted and radiated emissions limits in §§ 15.107 and 15.109, respectively. ***With this KDB publication, we also clarify that LED lighting devices are subject to all § 15.109 radiated emission limits, and that testing is required from 30 MHz to 1000 MHz for LED lighting devices, to ensure compliance with the radiated emissions requirements.***

GENERAL CONDITIONS OF OPERATION

Part 15 unintentional radiators are subject to operation on the condition that no harmful interference is caused.² Manufacturers and users should therefore note that lighting devices are required to cease operation if harmful interference occurs.³

To help mitigate interference from lighting devices into authorized radio services, responsible parties are encouraged to: use good engineering design and construction techniques to meet and even exceed the required attenuation of unwanted emissions; extend compliance testing beyond the frequency range guidance traditionally required; and provide suggested interference mitigation techniques to users on how to resolve harmful interference problems.⁴

¹ See 47 C.F.R § 15.3(m). There have been several recent instances of harmful interference caused by LED lighting devices that were found to be non-compliant with the FCC radiated and conducted emission limits. In particular, some self-ballasted LED lamps, and large LED displays (where a large number of LED panels are used for applications such as large advertising or video displays at arenas or stadiums) have caused interference to radiocommunications services.

² See 47 C.F.R. § 15.5.

³ For devices subject to Verification, the manufacturer, or in the case of imported equipment, the importer, is responsible for ensuring compliance. See 47 C.F.R. § 2.909(b).

⁴ See 47 C.F.R. § 15.15.

MEASUREMENT GUIDANCE

We have found that in many LED interference cases, the operating frequencies of the lighting device is not clearly identified, given the “broadband” nature of the emissions. Accordingly, in this guidance we clarify that all LED lighting devices, even those that have been considered to operate on frequencies below 1.705 MHz, are required to have radiated emissions measurements performed from 30 MHz to 1000 MHz in order to adequately demonstrate compliance with the § 15.109 radiated emission limits.⁵ Also, note that unintentional radiators are required to comply with the radiated emission limits even if measurements have not been performed on a particular device.

SUMMARY OF TECHNICAL REQUIREMENTS FOR PART 15 LIGHTING DEVICES

LED lighting devices that power a bulb, luminaire, or tube with the use of electronic driver circuitry are classified as unintentional radiators and are subject to equipment authorization under Part 15. A common example of this type of device is a self-ballasted LED lamp.

- *AC Power Line Conducted Emission Limits:* § 15.107(a) for Class B (residential) devices, or § 15.107(b) for Class A (commercial) devices, as appropriate.
- *Radiated Emission Limits:* § 15.109(a) for Class B (residential) devices, or § 15.109(b) for Class A (commercial), as appropriate. Radiated emission measurements are required to be performed from 30 MHz to 1000 MHz.
- *Equipment Authorization Procedure:* The “Verification” equipment authorization procedure is used for both Class A and Class B unintentional radiator devices.

⁵ We recognize that §15.33(b) specifies that when routine radiated emissions measurements are needed based on the highest frequency generated or used in the device, and when the frequency is less than 1.705 MHz, it is only necessary to perform measurements up to 30 MHz. However, we have investigated and determined that the emissions produced as a by-product of the driver circuitry within the LED lighting devices are generally non-periodic and broadband in nature, with adequate energy and potential to generate radiated emissions well above 30 MHz. To help mitigate interference from lighting devices, we henceforth explicitly require that radiated emissions testing be performed from 30 MHz to 1000 MHz, to demonstrate compliance with the applicable radiated emissions requirements.