



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

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RADIO FREQUENCY LED LIGHTING PRODUCTS

INTRODUCTION

Radio frequency (RF) light-emitting diode (LED) lighting products are subject to FCC rules to ensure that devices do not cause harmful interference to radiocommunications services.¹ This KDB publication clarifies how the FCC rules apply to these products, and outlines manufacturers' responsibilities for controlling interference. This publication does not address older legacy lighting technologies such as incandescent, fluorescent, and high intensity discharge (HID) lighting products.²

For the purpose of this publication, the term RF LED lighting is used for a device which has the primary function of generating light by electrically powering semiconductor materials. Such light generation is commonly intended for general illumination, and also includes other applications such as traffic signaling, roadway lighting, manufacturing processes, agriculture, etc. RF LED lighting devices intentionally generate RF energy via electronic power conversion or digital circuitry, but are not intended to radiate RF energy by radiation or induction and thus they are classified as unintentional radiators according to the FCC rules.³ RF LED lighting products today employ single or multiple LED chips, but can also include organic LEDs (OLEDs), polymer OLEDs, quantum dots, etc.

In most cases, RF LED lighting devices employ either an independent or an integrated electronic driver that operates at RF frequencies similar to those used in digital electronic products. As such, RF LED lighting devices are subject to the Part 15 rules for unintentional radiators, and are subject to the "verification" equipment authorization procedure. These devices are required to meet the line-conducted and radiated emissions limits in Sections 15.107 and 15.109, respectively.

With this KDB publication, we further clarify that RF LED lighting devices are subject to Section 15.109 radiated emission limits from 30 MHz to 1000 MHz to ensure overall compliance with radiated emissions requirements.

¹ See 47 CFR. § 15.3(m).

² Other lighting devices, such as fluorescent lighting devices, and LED retro-fit tubes intended to replace linear fluorescent tubes operated by RF ballasts, are subject to compliance with Part 18 and are not addressed in this guidance document. Incandescent lamps are not considered RF devices. Also, LED lamps powered by internal direct current (DC) power sources, without RF circuitry (operating at greater than 9 kHz), with a passive LED array load and delivering only DC current to LEDs, are not considered RF devices. Large LED digital displays are considered digital-device peripheral devices subject to FCC Part 15.

³ For definitions of LED lighting products, see, e.g., Energy Star[®] Program Requirements, Product Specification for Luminaires, https://www.energystar.gov/products/spec/luminaires_specification_version_2_0_pd and ANSI/IES RP-16-10.

GENERAL CONDITIONS OF OPERATION

Operation of Part 15 unintentional radiators is subject to the condition that no harmful interference is caused.⁴ Manufacturers and users should therefore note that lighting devices are required to cease operation if harmful interference occurs.⁵

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.⁶

MEASUREMENT GUIDANCE

Measurement Procedure. The AC power line conducted emissions and radiated emissions from the RF LED lighting device are to be measured in accordance with the procedures in ANSI C63.4-2014.⁷

Frequency Range of Radiated Emissions Measurements. Radiated emissions measurements shall be performed over the range of frequencies as specified in Section 15.33(b). We have found that in many interference cases involving RF LED lighting devices, the specified operating frequency of the lighting device is not consistent with the actual emissions, given the “broadband” nature of the radiated and conducted emissions generated by the device.

We recognize that Section 15.33(b) specifies when routine radiated emissions measurements are needed based on the highest frequency generated or used in the device. When the device’s internal frequency is less than 1.705 MHz, the rules stipulate the necessity to perform radiated emissions measurements only up to 30 MHz. However, we have found that emissions from RF LED lighting devices are non-periodic, broadband in nature, and are produced as a byproduct of the internal driver circuitry within the RF LED lighting device. These types of broadband, non-periodic emissions have adequate energy and potential to generate radiated emissions well above 30 MHz.

Accordingly, this guidance clarifies that all RF LED lighting devices, even those that have been considered to operate on frequencies below 1.705 MHz in the past, are required to have radiated emissions measurements performed at a minimum from 30 MHz to 1000 MHz, to adequately demonstrate compliance with the Section 15.109 radiated emission limits.

⁴ See 47 CFR § 15.5.

⁵ For devices subject to the verification procedure, the manufacturer, or in the case of imported equipment, the importer, is responsible for ensuring compliance. See 47 CFR § 2.909(b).

⁶ See 47 CFR § 15.15.

⁷ ANSI-ASC C63®-Electromagnetic Compatibility standards development committee has a project to develop measurement procedures for lighting devices (C63.29). When complete, we expect it will address in greater detail the measurement procedures and configurations to be used in determining compliance. See: http://www.c63.org/documents/misc/matrix/c63_standards.htm