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To: US FCC Office of Engineering and Technology
Via: Electronic Submission via FCC E-filing/KDB Home Page/Draft Laboratory
Division Publications
Submission Date:
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Regarding the following---

Draft Laboratory Division Publications Report
Office of Engineering and Technology

Title: LED Lighting Products
Short Title: LED Lighting
Reason: Clarification of Testing and Equipment Authorization requirements for
LED Lighting Devices
OET Publication: 640677
Keyword/Subject: Testing and Emission Limits for LED Lights

Question: What rules and approval procedures apply to LED lighting Devices?
Posted: January 6, 2016
Comments Due: January 8, 2016

Submitted Comments

These comments pertain to the recently released Draft FCC Clarification regarding testing and authorization requirements for LED Lighting Devices. Edward Yandek LLC commends OET for continuing to expend resources to develop guidance on this important subject. It is hoped these comments will add value to that process. *OET is urged to also strongly consider comments by other submitters and to further consider whether another draft with FCC observations might be prudent once all comments are evaluated in order to achieve the best guidance publication.*

- 1) On August 27, 2014, OET released its first Draft Clarification entitled *RF Lighting Products Meet all FCC Standards to Mitigate Potential Harmful Interference to Radio Services*. It was identified as Publication 640677. Comments were submitted regarding this draft. On October 22, 2015, another Draft Publication also identified as 640677 was posted, and is the subject of these comments.
- 2) This second Draft recently released for comment has been narrowed to apply 'LED Lighting Products'.
- 3) While non-LED RF lighting devices are already explicitly covered under Part 18, it is also true that Part 18 coverage can still benefit from some additional clarification, particularly the issue raised by OET in its 2014 Draft regarding the applicability of radiated limits regardless of operating frequency and expectations regarding the frequency measurement range. Although the priority of clarifying the LED situation is understood, since there is currently no explicit mention of LED lighting in existing FCC rules, or even in the current KDB, it is also important to still eventually clarify OET's expectation regarding Part 18 RF Lighting Devices, since Part 18 discharge RF lighting devices will still be prevalent for quite some time. To make this process simple, perhaps Publication 640677 should be dedicated to LED RF lighting devices as indicated by the current Draft, and a subsequent Publication, which can be modeled in format on the c LED publication, but with a different Publication number, can address discharge RF lighting devices (fluorescent and HID ballasts, compact fluorescent lamps, etc.).
- 4) Since comments have previously been submitted on the 2014 Draft publication, these comments by Edward Yandek LLC will now focus on the current document that has been narrowed to consider LED lighting products.

- 5) It would be helpful if OET would use clarifying language to make it very clear that OET's expectations do not apply to all 'LED lighting products' but specifically to covered LED lighting products per 47CFR. More specifically, since FCC's jurisdiction is for products that intentionally generate RF energy, which is defined by FCC as being above 9 kHz, it therefore follows that the Clarification and any potential future rulemaking that may be based on the Clarification would apply *to RF LED lighting devices*. Using this terminology would make it very clear that the *rationale for coverage is the same that has been historically developed for covered RF lighting devices under Part 18*. Just as Part 18 does not require equipment authorization for traditional 60 Hz fluorescent ballasts, or other incidental radiators, Part 15 and the Clarification regarding technical requirements would not cover LED lighting products that employ LEDs as the light source and also do not intentionally generate RF either as an intermediate function or as an operating function. A simple example would be an LED bulb that is only driven by a capacitor or some other circuitry scheme that does not intentionally generate RF. Another example would be LED holiday string sets that do not intentionally generate RF or employ digital circuitry that would generate RF. These are clearly LED lighting products, but they would not be subject to the Technical Requirements on Page 3 of the OET LED Lighting Products Draft.
- 6) This distinction should be made clear in the final document. OET's language in the second paragraph of the Draft KDB Publication implies substantially the same understanding as does OET's classification of RF LED lighting devices as Part 15 *unintentional radiators* in the first paragraph under General Conditions of Operation.
- 7) Following from (5) and (6), it would be useful for OET to **define** specifically what constitutes a 'LED lighting product' that must comply with the Technical Requirements and to employ similar terminology already used for Part 18 covered RF lighting devices.

Consider the following definition:

RF LED Lighting Device

A device which is an unintentional radiator of RF and for which the primary function is to electrically power semiconductor materials intended to generate light. Such light generation is commonly intended for general illumination but may also include 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 of induction.

Typical examples of such products today employ single or multiple LED chips, but can also include organic LEDs (OLEDs), polymer OLEDs, quantum dots, etc. The future may bring other types of semiconductor configurations that could readily be added to the KDB Publication if they become prolific in use.

- 8) The above definition is broad, and, would encompass LED lighting devices intended to be used for general illumination, including residential, commercial, industrial, street and roadway lighting, stage and studio lighting, traffic signaling, industrial processes and others, as long as the intent is to generate light (visible, UV, IR) via the use of semiconductors as the lighting generating mechanism and where there is also an intentional generation of RF energy contained in the function of the device .
- 9) Large LED digital display systems of the type mentioned in Draft foot note (1) should continue to be considered digital display devices under Part 15, since display, and not illumination, is their primary function. Such products would not be considered RF LED Lighting Devices, even if they use LEDs for individual pixel element of the large array display. Perhaps such display devices would benefit from a dedicated KDB Publication.
- 10) Following from (5) and (6) above, the second paragraph of the proposed 2015 KDB Publication should be changed to be consistent with the intended coverage by replacing the words 'Led lighting devices' with 'RF LED lighting devices' so as to make it clear that incidental radiators which might also employ LEDs but that have no intentional RF generating circuitry would not be subject to measurement and authorization requirements on Page 3 of the KDB Draft.
- 11) The Measurement Guidance proposed for the KDB is consistent with the fact that for most electronic LED drivers there is not merely one 'operating frequency' in the traditional sense. There may be a predominant power frequency similar to a predominant frequency for a switching power supply, but, as noted by OET, such power conversion circuitry also produces additional broadband emissions. Thus, OET guidance that radiated measurements for LED lighting devices that intentionally generate RF within the device should be performed from 30 MHz to 1000 MHz is appropriate and consistent with the fundamental purpose of Part 15.
- 12) The first paragraph under Summary of Technical Requirements for Part 15 Lighting Devices is somewhat confusing and requires discussion.

- 13) In keeping with the intended Title and Scope and Question for this KDB Publication, aforesaid comments, and what is stated at an earlier point in the KDB Draft, a more appropriate heading would be-

Summary of Technical Requirements for Part 15 *RF LED Lighting Devices*.

- 14) To provide the maximum amount of clarification given it is suggested that the first paragraph under the Summary heading on Page 3 be modified to provide guidance as follows:

RF LED lighting devices that provide power for any use where LEDs are employed as the predominant light source are classified as unintentional radiators and are subject to equipment authorization under Part 15.

Typical examples of high volume RF LED lighting devices include

- an integral (single piece) LED lamp/bulb that would replace legacy incandescent or halogen lamps/bulbs
- an independent electronic LED driver/power supply intended to power LEDs in any form factor including tubes, strips, strings, signs, OEM equipment, luminaires, or any configuration where LEDs are employed as the predominant light source

Specific Requirements

- 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.
- Labeling and information to the user as per : § 15.19, § 15.105

Measurement Guidance

- LED lamps/bulbs with an integral electronic (intentional RF generating) driver or power supply and LED light producing element must be tested as an integral unit.

- Independent electronic (intentional RF generating) drivers or power supplies must as a minimum be tested with their maximum rated nameplate loads and in a typical luminaire. The typical luminaire used should be indicated as part of the compliance test report.

Note: More recently, there have been discussions within the ANSI C63.29 Working Group, which includes OET, lighting, and test measurement representatives to evaluate drivers that are programmable or selectable for various load output power levels, which can potentially result in different interference profiles, by testing under four driver operating conditions-

- o Minimum Output Voltage and Minimum Output Current
- o Minimum Output Voltage and Maximum Output Current
- o Maximum Output Voltage and Minimum Output Current
- o Maximum Output Voltage and Maximum Output current

OET is encouraged to include such an evaluation protocol for programmable LED drivers once fully defined by the ANSI C63.29 Working Group.

- Luminaires intended for LED applications do not have to be tested as long as an RF LED driver or power supply included in the luminaire has previously been tested in a similar luminaire.
- In the event that a luminaire is of a type where the RF electronic driver/power supply is not of the independent type, but is mechanically integrated into the luminaire such that it is not readily removed or replaceable, then the complete luminaire assembly with its driver will be considered to comprise the RF LED lighting device and must be tested for compliance as a complete unit.

15) It is important to use a sufficiently complete list of key words to ensure this guidance is easily obtained when searching the KDB.

Suggestions include:

LED, Lighting, Solid State Lighting, LED Lighting, OLED, LED driver, LED power supply, luminaire, LED luminaire, lamp, bulb, RF Lighting, Lighting Device

- 16) Since there are many in the LED lighting industry who may still not be familiar with the KDB and its role in providing guidance, it would be highly advisable to also provide a Lighting link on the OET home page that could link to all KDB publications (as well as applicable Q&A) that are relevant to Lighting, both P15 and P18. In this way, as other future questions are asked and answered, there would be high likelihood that future guidance would be readily found by industry, users, retailers, trade associations, and specifying agencies. The current KDB content on relevant lighting subjects is woefully inadequate considering the fast moving implementation of this technology.
- 17) Although both a highly visible link to Lighting on OET's home page and an improved KDB set of key words be helpful in the short run, longer term, it would still be advisable to incorporate the salient portions of this Guidance into the applicable FCC Parts whenever revisions to the applicable Rules are undertaken. As a minimum this should be performed the next time there is a mandated review of Part 15 and 18.
- 18) Additionally, it would be helpful if OET would make available electronically the complete history of past FCC actions regarding RF Lighting equipment. Many of the items previously discussed as part of various proceedings documents would be helpful since they were instrumental in developing current requirements. Unfortunately, some of the most influential documents are not able to be found via the FCC or Fed Register search engines due to search limitations driven by their time frame. Having these petitions, NOIs, proceedings, Reports and Orders, etc., would do much to provide important background and help inform future considerations.
- 19) Since there is an active effort to develop a very comprehensive Methods of Measurement Standard for Lighting Equipment currently underway in ANSI C63, it would perhaps also be worth mentioning this activity via a foot note tied to the measurements guidance in the Final Publication of the intended OET KDB guidance.

END COMMENTS

Respectfully submitted by

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Brief Background of the Submitter:

Edward Yandek has a long standing involvement with EMC and other matters related to lighting products. He was instrumental in assisting FCC in developing the initial requirements for RF Lighting Devices under Part 18, adopted by the FCC in its Third Report and Order, Gen Docket 20718, FCC 85-445 (released Aug.21, 1985). He has also participated in other actions by FCC on matters related to RF Lighting devices, including the harmonization of technical requirement between FCC Part 18 and CISPR 15 regarding induction lighting devices. He is currently a member of the ANSI C63.29 Working Group as well as the Technical Advisor of the US TAG to CISPR F, and is a member of IEC CISPR F WG2 (Lighting) as well as IEC SC77A WG1 and the corresponding US TAG. Other affiliations include the IEEE EMC Society, the IEEE PES (Power and Energy Society) as well as the IES (Illumination Engineering Society). His experience in the areas of research, product development, engineering management, standards development, industry and consumer education, and public policy development related to lighting systems, energy, product safety, power quality, environmental and EMC matters, both nationally and internationally, spans a 47 year period.