

# Radio Frequency (RF) Interference from Energy-Efficient Lighting







FINAL REPORT June 30, 2015

**National Public Safety Telecommunications Council** 

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### **Background:**

The Energy Independence and Security Act of 2007 required improvements in energy efficiency of lighting equipment.<sup>1</sup> These requirements have led to the gradual phase out of traditional incandescent lighting and helped spur the development of energy-efficient lighting technologies. As a result, homes, businesses, and local, state and Federal government facilities are transitioning to compact fluorescent lighting, LED lighting, electronic ballasts, and other forms of energy-efficient lighting products. Therefore, energy-efficient lighting is a fact of life in our current environment. While energy-efficient lighting products have many benefits, experience shows they can also cause radio frequency (RF) interference, impacting nearby communications equipment, including that of public safety entities.

NPSTC was approached by several individuals and organizations who reported interference to public safety radio networks from energy efficient lighting. In October, 2014 NPSTC issued an initial query to the public safety community through the NPSTC Participant's Listserv which resulted in dozens of responses. For example, Lake County, Florida reported interference to the public safety VHF band and Amateur bands after installing new tower lighting on its radio sites. Las Vegas, Nevada experienced extreme interference in the UHF band from a business using excited plasma lights. An incident management team operating at a fire in northern California in August 2012 had set up and tested all of its communications equipment. During the evening operational period all communications failed. The source was determined to be a string of overhead fluorescent lights. Quebec, Canada reported interference problems on its public safety VHF trunking system from LED lighting made by a variety of manufacturers, which created a strong interfering signal within 100 meters of the building.

### **NPSTC Questionnaire:**

Based on the initial input from these agencies, NPSTC developed and compiled a more formal questionnaire which was distributed broadly throughout the public safety community on January 19, 2015. The online questionnaire was closed on February 13, 2015. NPSTC designed the questions to seek information on the frequency band(s) affected, how any interference manifested itself, whether the interference has been resolved, etc. Appendix A includes the full list of questions asked.

<sup>&</sup>lt;sup>1</sup>PUBLIC LAW 110–140—DEC. 19, 2007, Subtitle B, Lighting Energy Efficiency

### **NPSTC Survey Results**

Seventy-six (76) public safety agency representatives responded to the questionnaire. Fifty-five (55) of those responding said they had no interference with the remaining twenty-one (21) providing some details on the interference they had experienced.

The following chart summarizes the input from those 21 responses.

Survey Respondent	Interference Cause	Band(s) Affected	How Affected	Impact Area
Anonymous	Traffic Lights and associated ground-mounted light controllers and transformers	VHF; UHF	Noise in mobile or portable radios. Noise rises as traffic signals change or blink	100-200 feet of intersections
Linda Fire Protection District	Florescent light ballasts	VHF	Nuisance level of noise and garbled transmissions on portable radios and pagers	Inside the Fire station
New York State DOT	Multi-voltage ballasts for florescent lighting	VHF Lowband	Noise, Loss of coverage, garbled transmissions impacting portables, mobiles and base receivers.	Within 50 yards of facility
State of California	Indoor and outdoor lighting- When magnetic ballasts in florescent lights were changed to electronic ballasts; also worsened when LED lighting tried.	VHF Lowband	High noise on Low- band increased; loss of coverage. Impacts portables, mobiles and base receivers.	Station parking lots and garages
Oregon DOT	LED traffic lights; an LED flashlight next to portable radio	VHF	Loss of coverage to mobiles and portables; also to consumer FM car radios	Within 50-75 feet of LED traffic lights. Within about 14 inches of LED flashlight
Industry Canada	Electronic ballasts for florescent lights in nearby store	800 MHz cellular band	Broadband noise 20 MHz wide caused loss of coverage/dropped cellular calls	Within 2 km
P3 Communications	LED billboards. Have performed many interference investigations for cellular carriers	700 MHz cellular band	Increased noise for cellular base stations	Within a few hundred yards

Survey Respondent	Interference Cause	Band(s) Affected	How Affected	Impact Area
Government of	Found 15 locations in	VHF	Loss of coverage,	Within 250 meters
Quebec, Canada	City with		noise and garbled	but distance varies
	interference cause by		transmissions on	
	lighting.		portables and	
			mobiles	
Tenafly Fire Dept.	High efficiency	VHF Lowband;	20 dB increase in	Not specified
(New York)	interior lighting; also	700/800 MHz	noise floor	
	some new FAA tower			
	lighting			
Consultant	LED Lighting inside	HF (1.8-30 MHz);	Loss of coverage,	Mostly inside mobile
	Sheriff's Department	VHF Lowband; VHF	noise and garbled	communications van
	Mobile		transmissions on	
	Communications van		portables, mobiles	
			and base stations.	
Sprint	Ballasts, jewelry	800 MHz cellular	Loss of coverage,	Within ¼ mile
	store display window	uplinks	noise and garbled	
	lighting, ceramic		transmissions	
	metal halide lights			
	with integrated			
	ballasts			106
Warren County	LED blue lights on	VHF	Pulsing and buzzing	10 foot radius around
	vehicle with internal		noise in portable and	vehicle
	switching power		mobile radios when	
0 0	supply	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	LED lights flashing	N. (1) 1 75 ( )
Ontario, Canada	Electronic ballasts	VHF	Loss of coverage,	Within 75 feet;
Ministry of Health	installed at		noise and garbled transmissions on land	affects any
	ambulance base facilities (400 such		mobile base	ambulance parked at its base facility
	base facilities in the		receivers and paging	its base facility
	Province of Ontario)		base receivers	
Summit County,	High Efficiency	800 MHz	Loss of coverage with	Within approx. 15
Ohio-Coventry Fire	Lighting ballasts	000 141112	portable radios	feet of each
Station	installed in Fire		portubie rudios	defective ballast
	station			derective bands
KITTCOM - Kittilas	Installation of	VHF	Loss of coverage,	Within same room of
County, Washington	florescent fixture in		noise and garbled	same building
911	fire station. Fixture,		transmissions on	
	purchased from		portables, mobiles	
	bigbox hardware		and pagers	
	store was imported			
	and found not to be			
	FCC certified.			
US Coast Guard	LED and Florescent	VHF; UHF; 700/800	Locks up radio	Since it locks down
Auxiliary	lighting inside and	MHz	systems in scan or	system in scan or
	outside building		trunked mode;	trunked mode,
			impact to portable,	impact is to wide
			mobile and base	area.
			stations.	

Survey Respondent	Interference Cause	Band(s) Affected	How Affected	Impact Area
Washington Dept. of	LED overhead	VHF	Noise on channel	Within the mobile
Natural Resources	lighting in a mobile		impacted	repair vehicle
	shop repair vehicle		troubleshooting and	
			repair	
Town of Bennington	TBD if interference is	VHF	Loss of coverage,	
Rescue Squad	caused by the LED		noise; garbled	
	emergency lights,		transmissions.	
	interior Fluorescent		Impact to portables,	
	lighting, or radio		mobiles, base	
	equipment issues		receivers an dispatch	
	from Narrowbanding		locations.	
Texas DOT	LED red lights on	VHF	Loss of coverage,	Within 20 feet from
	tower beacon when		noise; garbled	antenna tower
	flashing		transmissions.	
			Impact to portables,	
			mobiles,	
County of	LED street lights	Below 30 MHz	Noise on mobile	Within 150 feet of
Westchester, NY			radios	LED lights. Lights are
				20 feet overhead.
United Radio	Residential LED	VHF Low band, HF	Noise on portable	Within 15 feet
Communications, Inc.	lamps	amateur bands and	radios	
		FC broadcast band		

As shown, the interference cases reported span across multiple bands and situations, with the VHF and VHF Lowband most often mentioned. In some cases, questionnaire respondents provided additional information not shown in the chart above concerning the manufacturer of the interfering devices. That additional information shows that offending high efficiency lighting devices emanate from multiple manufacturers, i.e., no one manufacturer is at fault. The results of the questionnaire indicate that while not yet large in number, interference from high efficiency lighting appears to be a growing problem.

### **Recommendations**

While cases of interference to communications from energy-efficient lighting is not yet at epidemic proportions, NPSTC believes additional attention should be paid to the issue. NPSTC expects the instances of interference to expand going forward as building codes and interests in saving energy further increase the pressure to deploy energy-efficient lighting. For example, section R404.1 of the 2012 International Energy Conservation Code (IECC) requires that "a minimum of 75 percent of the lamps in permanently installed lighting fixtures shall be high-efficacy lamps." The percentage has been raised from 50% in the 2009 code.<sup>2</sup>

The code defines a high-efficiency lamp as either:

- A compact fluorescent lamp (CFL);
- A T8 or smaller linear fluorescent lamp; or
- Any lamp meeting the following minimum efficiency requirements: 60 lumens per watt for lamps over 40 watts,
   50 lumens per watt for lamps over 15 watts but no more than 40 watts, and 40 lumens per watt for lamps rated at 15 watts or less.

<sup>&</sup>lt;sup>2</sup> See <a href="http://www.greenbuildingadvisor.com/blogs/dept/musings/overview-2012-energy-code">http://www.greenbuildingadvisor.com/blogs/dept/musings/overview-2012-energy-code</a>

This definition excludes incandescent light bulbs. While LED lighting accounted for only about 2% of the commercial market share in 2011, it is expected to climb to 52% over the next ten years.<sup>3</sup> Energy-efficient lighting is an integral element of energy conservation programs with public benefits, however, steps need to be taken to minimize the risk of interference from such lighting devices and systems.

NPSTC notes that the FCC equipment certification standards were developed long before energy-efficient lighting equipment became popular. NPSTC understands there is some uncertainty in the industry whether new energy-efficient lighting equipment must meet the emission limits of Part 15 of the FCC rules or the limits in Part 18 of the rules. Further, given the interference from energy-efficient lighting is a relatively recent phenomena, there may be some confusion about the device limits required to prevent such interference.

There has been some regulatory activity regarding interference from high-efficiency lighting. For example, in 2013 and 2014, the FCC investigated interference to a Verizon 700 MHz network in Los Angeles. The source of the interference was found to be electronic ballasts in the florescent lighting at a nearby 41-story office tower.<sup>4</sup> Also, the FCC Office of Engineering and Technology Laboratory Division periodically issues "Knowledge Data Base (KDB)" publications which are aimed at clarifying issues for which there has been industry questions or confusion. In August 2014, the FCC Lab issued a draft publication which notes some instances of interference from electronic ballasts and LED lighting have occurred. That draft publication addresses testing procedures for those devices.<sup>5</sup> As of June 2015, this publication is still pending in draft form and has not yet been published in final.

Any FCC rulemaking action normally entails a multiyear process. Therefore, NPSTC recommends the FCC open a proceeding to address these and other issues surrounding energy-efficient lighting. NPSTC recommends that this issue be examined with the goal of <u>preventing</u> interference rather than having to resolve it after the fact once high efficiency lighting devices are deployed in the field.<sup>6</sup> That implies better adherence to FCC certification standards and/or more rigorous standards than those currently in the rules. Given some responses to the NPSTC questionnaire from Canada, similar attention by Industry Canada may also be needed.

In addition to design, certification and testing of energy-efficient lighting, installation techniques, especially in commercial and industrial lighting installations, may also impact the risk of interference. NPSTC notes the need for best practices for the procurement and installation of these systems.

<sup>&</sup>lt;sup>3</sup> Executive Summary: Energy Efficient Lighting for Commercial Markets, Pike Research, Published 4Q 2011. http://www.navigantresearch.com/wp-content/uploads/2011/11/EEL-11-Executive-Summary.pdf

<sup>&</sup>lt;sup>4</sup> LA Building's Lights Interfere with Cellular Network, FCC Says, PC World, February 7, 2014. http://www.pcworld.com/article/2095940/la-buildings-lights-interfere-with-cellular-network-fcc-says.html

<sup>&</sup>lt;sup>5</sup> Federal Communications Commission, Office of Engineering and Technology, Draft Laboratory Division Publication: RF Lighting Products Must Meet All FCC Standards to Mitigate Potential Harmful Interference to Radio Services, Publication number 640677, August 27, 2014.

<sup>&</sup>lt;sup>6</sup> NPSTC notes plans are underway to close some of the FCC's Enforcement Bureau Field Offices. At the time of this report, the extent of the closures appears to be less than originally planned, however, NPSTC believes it is still smart to take the necessary measures to help prevent interference at the outset.

## Appendix A

# NPSTC Questionnaire Re RF Interference from Energy-Efficient Lighting

1. Have you experienced any cases of interference to your public safety radio system caused by energy-efficient lighting?
( ) YES - please continue to the next question ( ) NO - there is no need for you to continue with the survey
2. Agency Name:
3. Name of person completing this survey:
4. Please provide your email address so we may contact you if we need further information:
5. Please provide a general description of the problem. Tell us when you first noticed the interference and to what extent the interference impacted public safety operations.
COMMENT:
<ul> <li>6. What type of interference did your agency receive?</li> <li>( ) Loss of coverage (mobile or portable radio could not receive)</li> <li>( ) Noise on channel (radios received interference signals)</li> <li>( ) Garbled transmissions (user voices are mixed with interference noise)</li> <li>( ) Other:</li></ul>
<ul> <li>7. Did the interference cause problems for:</li> <li>( ) Portable radios</li> <li>( ) Mobile radios</li> <li>( ) Base station Radios or Satellite Receivers?</li> <li>( ) Dispatcher consoles</li> </ul>
8. In which frequency bands did you notice the interference?
[Check all that apply]
( ) VHF Low Band ( ) VHF 147-174 MHz ( ) UHF 450-512 MHz ( ) 700/800 MHz ( ) Other:
9. How did you determine that energy-efficient lighting was the cause of the interference?
COMMENT:
10. What was the energy-efficient lighting source?

( ) External Building Lights ( ) Internal Building Lights ( ) Tower Lighting ( ) Other
11. How close in distance were the radios/equipment receiving interference to the energy-efficient light sources? (i.e., was the interference wide spread or localized to a single/individual first responder portable or mobile radio near the LED lighting source?)
COMMENT:
12. Please explain what steps were taken to resolve the interference?
COMMENT:
<ul><li>13. Did you successfully resolve the interference problem?</li><li>( ) Yes</li><li>( ) No</li></ul>
14. Please provide any information on the energy-efficient lighting equipment involved. (Please list manufacturer, model number, or other information that would help identify the device)
COMMENT: