

**IEEE P802.15****Wireless Personal Area Networks**

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Project	IEEE P802.15 Working Group for Wireless Personal Area Networks (WPANs)	
Title	<b>802.15.4m Coexistence Assurance Document</b>	
Date Submitted	[16 January 2013]	
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Re:	802.15.4m Draft Standard	
Abstract	Coexistence Assurance Document	
Purpose	Present analysis of the expected coexistence in TVWS bands of 802.15.4m devices.	
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Release	The contributor acknowledges and accepts that this contribution becomes the property of IEEE and may be made publicly available by P802.15.	

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## Introduction and Overview

At this time, there are two approved standards for operation in the TV white spaces bands: IEEE 802.22-2011 and IEEE 802.22.1-2010. This document shows the coexistence impacts of the proposed 802.15.4m operation with respect to 802.22 and 802.15.4m devices.

Currently white space rules have been published in the United States, and other regions have rules pending. This analysis is based on the rules as published by the FCC. Current FCC rules (Part 15, subpart H) include the concept of a geo-location database containing availability of whitespace channels; 802.15.4m assumes some participating devices have access to the geo-location database. Regulatory work in other regions is ongoing.

Power limits defined by FCC regulations for whitespace devices are given in Table 1. The maximum transmit power for fixed devices is limited to 1W transmit power in a TV channel; if occupied bandwidth of the signal is less than that for a TV channel, transmit power must be scaled down so that total power in the TV channel does not exceed 1W. Non-fixed devices are constrained to lower transmit power, with the same requirement to scale power relative to occupied bandwidth.

Table 1: FCC Transmit Power Limitations

Type of TV bands device	Power limit (6 MHz)	PSD limit (100 kHz)	Adjacent channel limit (100 kHz)
Fixed	30 dBm (1 Watt)	12.6 dBm	-42.8 dBm
Personal/portable (adj. channel)	16 dBm (40 mW)	-1.4 dBm	-56.8 dBm
Sensing only	17 dBm (50 mW)	-0.4 dBm	-55.8 dBm
All other personal/portable	20 dBm (100 mW)	2.6 dBm	-52.8 dBm

## Coexistence with 802.22

### Impact of 802.22 on 802.15.4m

Figure 1 shows the interference levels at a 802.15.4m receiver as a function of distance when using the power level of 1W as allowed by FCC (Table 1) and for a wireless signals occupying the TV channel.

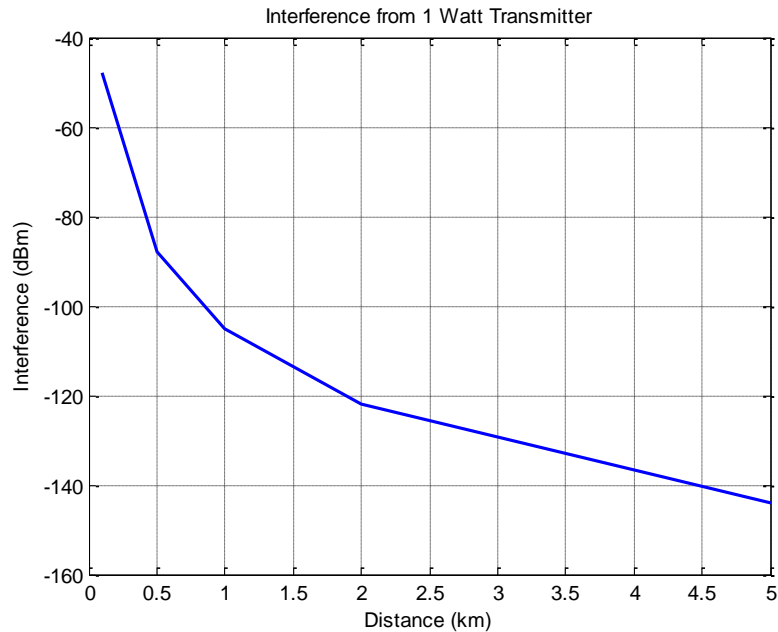


Figure 1: Interference vs Distance

With physical separation of 1 km or greater the interference footprint of the 802.22 system on the 802.15.4m is at or below typical expected noise levels. The narrower occupied bandwidth used in 802.22.1 the power scales down with bandwidth.

### Impact of 802.15.4m on 802.22 devices

The impact of an 802.15.4m transmitter on 802.22 receivers will be similar to the case above. For the narrower channels used by 802.15.4m, transmit power and noise threshold scale together so it reduces to a symmetric impact and equivalent results are expected. In addition, channel estimation schemes can be used to mitigate against narrowband interferers for improved performance.

### Additional Interference Mitigation Mechanisms

Many mitigation techniques exist in the 802.15.4 for detection and avoidance of interference with both similar and dissimilar systems, including multiple CCA based on energy detection, CSMA, inherently low duty cycles, support for frequency hopping, and spread spectrum techniques. This standard supports as similar techniques as described in 802.11af. Coexistence Assurance Document [1] for coexistence with in TVWS bands. Other examples may be found in [2].

### References

- [1] Doc # 802.11-11/0177r1 "11af Coexistence Assurance Document"
- [2] Doc # 802.15-12-0341-01 "TG4k Coexistence Document"