Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington, DC 20554

In the Matter of	)	
	)	
Unlicensed Operation in the TV Broadcast Bands	)	ET Docket No. 04-186
	)	
Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band	)	ET Docket No. 02-380

To: The Commission

COMMENTS REGARDING WHITE SPACE DEVICES AND WIRELESS MICROPHONE USE

My name is Michael J. Benonis, and I am a fourth-year undergraduate in electrical engineering at the University of Virginia in Charlottesville, VA. In addition to my course of studies in communications in the electrical engineering department, I also work at the University's Department of Drama as the resident sound engineer. In my capacity as sound engineer, I manage a brand new sixteen-channel wireless microphone system that operates in the UHF television band below 698 MHz (TV channel 52). This system is used year-round for theatrical performances, presentations, and other departmental uses. It would be a tragedy if this wireless microphone system were to receive direct interference from a new, unlicensed White Space Device ("WSD") that was incapable of detecting our microphones. However, I believe that interference to this system, and to most wireless audio devices, such as wireless microphones, interruptible fold back systems, and intercom systems, is completely avoidable if proper precautions are taken.

I believe that there are two options to completely avoid interference to wireless audio devices. The first option is simply to move the wireless audio devices to a different part of the

RF spectrum. Many major manufacturers are investigating this option, but due to the cost of completely replacing a wireless audio device system, it does not solve the immediate crisis facing millions of wireless audio devices users across the United States.

The second option is for WSD's to have knowledge of wireless audio devices in their vicinity, and to avoid transmitting on channels that any wireless audio devices is operating on. There are three commonly discussed options for this: spectrum sensing, geolocation, and beaconing.

Spectrum sensing requires a WSD to scan the spectrum that it wishes to operate in prior to transmitting. Recent tests[*] have shown that while this method works quite well for digital television detection, it does not work well at all for wireless audio device detection. While it is certainly possible to improve the spectrum sensing, it cannot be the only method of interference mitigation to wireless audio devices.

Geolocation has also been commonly discussed as a possibility to mitigate interference to wireless audio devices. Geolocation relies on a WSD knowing its present location (using GPS, for instance), and then comparing this to a database containing a list of frequencies in use in that vicinity. Tests[*] of WSD's have shown that this works quite well if the device's database is current and up-to-date. However, one can easily imagine a situation where the data may be old and the device cannot connect to the internet to download a new copy of the database, or where last minute changes must be made to a wireless audio device's configuration that would nullify the benefit of a database. I believe that any geolocation-based system would require a database expiration mechanism, to force regular updates to the WSD's database. In addition, geolocation must not be the only method of interference mitigation to wireless audio devices.

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[*] See FCC/OET 08-TR-1005, "Evaluation of the Performance of Prototype TV-Band White Space Devices, Phase II", October 15, 2008.

Beaconing has been promoted as a very safe and convenient way to mitigate interference, because the users of wireless audio devices control them. In the form that has been suggested by various third parties, beacons would operate on the same frequencies that wireless audio devices operate on (to "mark the channel"), and be turned off when the wireless audio devices come on. This type of beaconing, unfortunately, is not likely to be useful because it requires a significant capital outlay for the users of wireless audio devices due to the quantity of devices needed. However, I believe that the concept of beaconing should be investigated further.

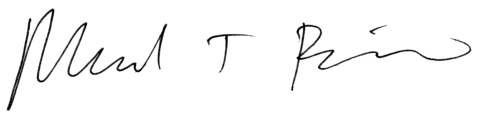
One method of beaconing in particular that I believe should be researched is the idea of a installing a single beacon on a predetermined frequency that can digitally transmit a list of frequencies in use at a location. Only one beacon would be necessary for small- to medium-sized venues, such as theatres and schools (depending on the physical configuration of the venue). In addition, the beacon could transmit using a reasonable amount of power into a good antenna, and beacons have the potential to be very cost effective if mass produced. That said, to my knowledge there has been no proof-of-concept for a digital data beacon, and extensive research is necessary to determine if the idea is even feasible in real-world situations. This idea is *not* ready for immediate deployment, nor will it be in the near future – but it is worth investigating.

It is my belief that using a combination of these three methods of interference mitigation, it is possible to eliminate most, if not all, potential interference to wireless audio devices. Extreme care must be taken in the implementation of all three methods to ensure that they are effective, though. One poorly designed WSD can cause untold damage to licensed broadcasters and users of wireless audio devices.

Interference mitigation is a good first step, but more action from the Commission is needed. The Commission *must* recognize wireless audio devices as legal users of the spectrum. Under the Part 74, Subpart H of the Commission's rules, only broadcasters and other specific entities are eligible for a license to operate a wireless microphone or other broadcast auxiliary service device. It is essential that the Commission continue to recognize licenses currently issued under this Part. In addition, current unlicensed users must be grandfathered in as legal, unlicensed users (who must not cause harmful interference to any licensed users).

I urge the commission to take these suggestions into account as it decides whether to allow unlicensed White Space Devices to be used in the United States. I also urge the Commission to proceed with the utmost caution, because once White Space Devices become available in the marketplace, it will be impossible to mitigate any interference that they may cause to both broadcasters and wireless audio devices, now or in the future.

Respectfully submitted,



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