

Wireless Microphones after Feb 2009

On February 17th 2009 Broadcast TV will complete the transition from analog NTSC to digital ATSC broadcasting. Along with this transition there has arisen a vibrant political debate over the utilization of 'White Spaces'. White spaces are the channels in the Broadcast TV spectrum that will not have licensed broadcasters operating in them. This transition and the results of the white space debate will have a potentially serious cost impact on current users of wireless microphones. There has been a lot of misleading or inflammatory information released from differing sides in the political debate. This article is an attempt to present the facts separated from the hype. The data for this article has been collected from variety of publicly available sources. The conclusion of this article will provide recommendations on what microphones will need to be replaced to be compliant with the FCC regulations before February of 2009.

On Wednesday, February 8th, 2006 The President of The United States signed legislation into law that contained the "Digital Television Transition and Public Safety Act". This sets February 17th, 2009, as the cutoff date for Analog TV Broadcasts. This changeover is also being used by the government to free up frequency spectrum at the upper end of the broadcast television range for public safety networks and to be auctioned off for private use. In conjunction with this changeover there are initiatives by industry organizations who are lobbying the government to allow unlicensed devices more freedom to operate within the TV spectrum. Part 15 of the FCC rules permits the operation of authorized low power RF devices without a license from the commission. This section of the rules sets up maximum power field strengths and bandwidths of transmitting devices. The microphone manufacturing industry is lobbying the government to keep the status quo and not allow expansion to the rules governing unlicensed devices to use the spectrum. If the FCC allows more devices to use this space there will be a consequence to the reliability of existing wireless microphone systems.

As of February 17th 2009 the following Broadcast TV Bands will cease transmitting analog NTSC. Most broadcasters at this point are broadcasting simultaneously in ATSC digital format and NTSC analog format on 2 separate channel allocations. Individual stations will give up one of their assigned broadcast channels and will continue broadcasting digital on the other as of the cutoff date. The following is a list of channel frequency allocations that will still be available for digital broadcast. Each channel occupies a 6 MHz band:

Channel 2-4 (54MHz - 72MHz)

Channel 5-6 (76MHz - 88MHz)

Channel 7-13 (174MHz - 216MHz)

Channel 14-36 (470MHz - 608MHz)

Channel 38-51 (614MHz - 698MHz)

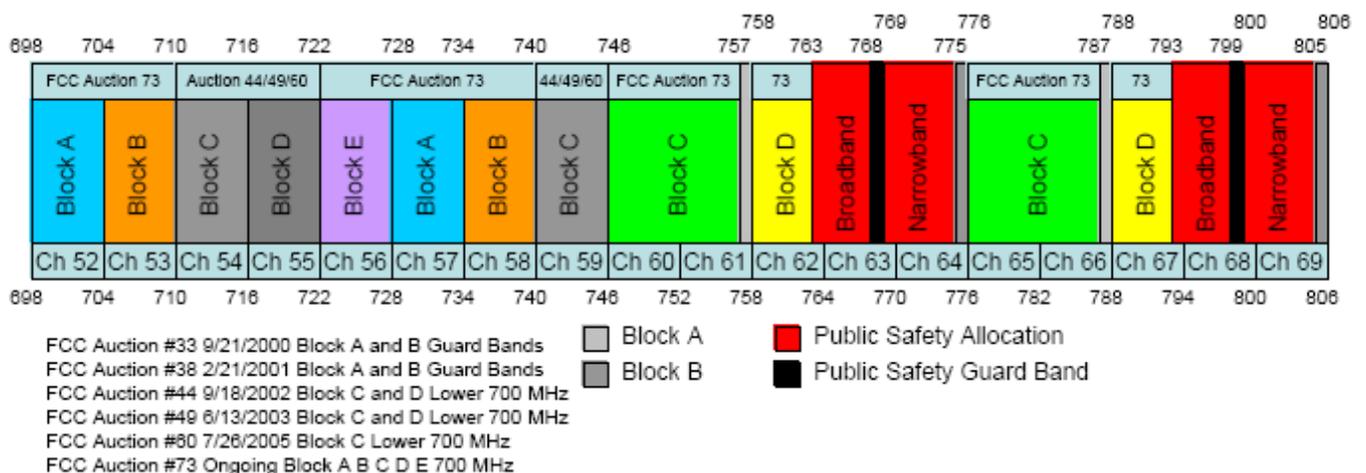
*[Channel 37 (608MHz-614MHz) is reserved for Radio Astronomy]

The unused channels in this spectrum are the contested areas referred to collectively as 'White Spaces'. White spaces are frequency allocations reserved for Broadcast Television where no licensed broadcaster will be transmitting an ATSC digital television signal. Channels within this white space will still be available for use by licensed or unlicensed devices such as wireless microphones after Feb 2009 just as they are now. Wireless microphones, although many exceed the transmission field limits established by Part 15 of the FCC rules, can be argued as legal users of this white space spectrum because microphone manufacturers require the end user to register them and obtain licenses to use the frequencies under Part 74. However, in practical terms this is almost never done. In most cases wireless microphones are operating as unlicensed devices in the unused broadcast spectrum just as other consumer wireless devices. Due to the very narrow bandwidth of wireless microphone systems, which are typically in compliance with Part 15 of the FCC rules, there are very rarely frequency interference issues except in the most densely populated areas or in areas saturated with broadcast TV transmitters.

There is an initiative underway by some major corporations (among them; Microsoft, Google, Dell, HP, Intel, Phillips, EarthLink, and Samsung Electro-Mechanics) to lobby the FCC to legally allow more robust use of white spaces after the February 2009 date by unlicensed consumer devices. The FCC is conducting proceedings under ET Docket No. 04-186 concerning this matter. The FCC has published a "Plan for Testing Personal/Portable TV White Space Devices". In this document it lays out the criteria that consumer devices must meet in order to be allowed to use the white spaces. The document lays out a number of bench and field tests that a device must pass in order to be approved to operate. Part one of this plan is "Television-Related Tests" and is designed to ensure there is no interference with television signals. Part II of this document is called "Microphone Related Tests" and is designed to verify that the new devices will not interfere with microphones. The test conditions for both parts verify that unlicensed consumer devices using the space would be mandated to have agile frequency capability and discriminating circuitry that would allow the devices to find and avoid active signals. The microphone industry is lobbying to prevent the FCC from authorizing the expanded use of white space by commercial devices. There are several valid reasons that the microphone industry would like to prevent competing devices from operating in these frequencies. These reasons have nothing to do with interference to digital television signals as some of the hype suggests. Here are the primary concerns that the microphone industry has with allowing competing licensed or unlicensed devices to operate in the broadcast TV spectrum. First, the potential number of other devices in this spectrum would make it difficult to find sufficient open frequencies in densely populated areas or areas with a high concentration of RF. For places like Broadway in New York, Sports Stadiums, and Concert Venues this would be a particular issue given the number of wireless channels in use at any given time. Second, portable devices in this frequency range would potentially be moved into and out of areas where microphones are operating. This could interfere with the established links between microphone transmitters and receivers. There could be dropout issues as agile transmitters and receivers renegotiate to find open frequencies. This is less of an issue to the consumer products, such as a child's video game or a mobile phone broadband connection, where a pause of a half second would have little effect. For a real-time device such as a wireless microphone a half second dropout would be unacceptable. Third, If the FCC allows other licensed or unlicensed devices in this bandwidth it will be with regulations requiring them to be frequency agile and automatically discriminate between open bandwidth and used spectrum. These requirements may also be applied to new wireless microphones. There would be substantial costs involved in engineering and producing wireless microphone devices to comply with whatever regulations are enacted. The results of this regulatory issue could have a cost impact on the purchase price of compliant wireless microphone systems and at worst could mandate that only approved systems be used.

That is the potential impact. Here is the immediate impact of the frequency changeover in February of 2009. The following frequencies will cease being used for broadcast television and will be either reallocated to Public Safety or auctioned to new services. Microphones in this range must cease transmitting and be replaced with systems outside of this frequency spectrum.

Channels 52-69 (698MHz - 806MHz)



The public safety frequencies in this range will be strictly off limits for use by unlicensed wireless devices including microphones. Frequencies in the auctioned spectrum may still be usable by unlicensed wireless microphones depending on whether the new owner of the spectrum is transmitting in the area. The owner of the frequency spectrum will have exclusive rights to its use however and can mandate no other transmissions in their range. It will not be possible to legally license a microphone for use in any these frequencies.

All wireless microphones must cease transmitting on the following frequencies by February 2009:

Part of TV Channel 62, all of 63 and most of 64 (763MHz -775MHz)
 Part of TV Channel 67, all of 68 and most of 69 (793 MHz - 806 MHz)

In addition the following frequencies are designated by the FCC for dual use between Broadcast TV and Land Mobile Radio and should be avoided for wireless microphones:

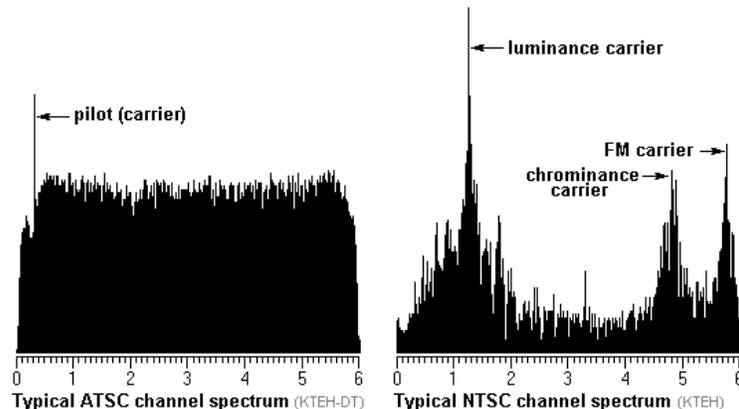
Channel 14-20 (470MHz - 512MHz)

In the following cities these dual use frequencies are used by public safety. Wireless microphones must not transmit on them*:

- Boston 14 (470 MHz - 476 MHz), 16 (482 MHz - 488 MHz)
- Chicago 14 (470 MHz - 476 MHz), 15 (476 MHz - 482 MHz)
- Cleveland 14 (470 MHz - 476 MHz), 15 (476 MHz - 482 MHz)
- Dallas 16 (482 MHz - 488 MHz)
- Detroit 15 (476 MHz - 482 MHz), 16 (482 MHz - 488 MHz)
- Houston 17 (488 MHz - 494 MHz)
- LA 14 (470 MHz - 476 MHz), 16 (482 MHz - 488 MHz), 20 (506 MHz - 512 MHz)
- Miami 14 (470 MHz - 476 MHz)
- NY 14 (470 MHz - 476 MHz), 15 (476 MHz - 482 MHz), 16 (482 MHz - 488 MHz)
- Philadelphia 19 (506 MHz - 512 MHz), 20 (506 MHz - 512 MHz)
- Pittsburgh 14 (470 MHz - 476 MHz), 18 (494 MHz - 500 MHz)
- San Francisco 16 (482 MHz - 488 MHz), 17 (488 MHz - 494 MHz)
- Wash DC 17 (488 MHz - 494 MHz), 18 (494 MHz - 500 MHz)

* This information compiled and released by Shure Inc.

Due to the narrow bandwidth of a wireless microphone signal it is currently possible to transmit and receive a wireless microphone signal in either the guard band or center of an active 6 MHz broadcast channel with an NTSC signal. The wireless microphone signal would appear as a spike similar to the FM Carrier signal on the diagram below. You can see from the diagram that there is quite a lot of available space even within the NTSC channel spectrum where a wireless microphone could operate without affecting television reception. With an ATSC signal this will not be possible. As you can see from the diagram below ATSC will utilize the entire 6 MHz bandwidth allocated to each broadcast TV channel allowing no room for additional devices to be inserted.



Conclusions:

Current wireless microphones that operate in the broadcast TV spectrum in the channel 52-69 range must be turned off and/or replaced by February 2009. This frequency range will belong to either public safety or individual corporations that acquire part of the spectrum at auction. Microphones in the auctioned frequencies may still function in a given area if the new owners of the spectrum are not utilizing it but should not be used.

Current wireless microphones that operate in the broadcast TV spectrum in the channel 14-20 range will still work as they do now after the February 17th 2009 deadline. However, these frequencies are being utilized for radio communications by public safety in some jurisdictions. If those frequencies are used by public safety, in the city of installation, they must cease transmitting and be replaced with microphones outside of this spectrum.

Current wireless microphones that operate in the broadcast TV spectrum in the channel 2 - 51 range will still work as they do now after the February 17th 2009 deadline. They will still typically be operated as unlicensed devices in the unutilized broadcast TV channels. If the FCC provides regulation guidance authorizing the use of unlicensed devices within this spectrum then there will be repercussions to the wireless microphone industry. At the very least, microphones will be allowed to still operate if within the Channel 2-51 range and will only have to contend with additional competition for the available bandwidth with devices that detect TV and microphone signals, and avoid those frequencies. At worst, existing microphones may have to be modified to meet the requirements new regulations or replaced with microphones that meet those requirements as well as competing with other devices for a much more crowded spectrum. This FCC decision could potentially force a major engineering redesign in how wireless microphones work and may require purchase of new equipment. Another alternative being explored by the microphone industry is moving to uncontested frequencies in other bands. The outcome of the FCC proceedings will determine what if any other changes will be mandated but it appears that the FCC is taking into account wireless microphones in their testing criteria so there is reason to believe that it will be necessary to replace microphone systems that are in the Channel 2-51 range. In short, it will currently only be necessary to replace existing equipment if it falls within the public safety frequencies or the auctioned spectrum.

Edwin D Morman, CTS-D CTS-I
RTKL Inc.