

**BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION**

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
)	

**COMMENTS OF NEW AMERICA FOUNDATION:
University of Kansas TV Band Interference Study**

The attached report presents the preliminary results of a feasibility study regarding the ability of secondary (unlicensed) users to operate within unused TV band spectrum without causing “harmful interference” to consumer DTV receivers. The study, commissioned by the New America Foundation, reports the results of testing conducted over the past several months – and still ongoing – at the University of Kansas Information & Telecommunication Technology Center.. We hope this study and future results from the work being done in this area at the University of Kansas will help provide a sound factual basis for FCC technical decisions in Docket 04-186.

The FCC uses two key regulatory parameters as part of the technical rules to reduce the potential for harmful interference between separate uses of the RF spectrum: out-of-band emission and the primary emission levels.

Out-of-band emissions (OOBE) are those part of a RF transmission that “leak” out from the band in which the device is emitting into an adjacent band. It is straightforward to understand that any emissions into another band would be considered interference. The primary question is that if these emissions are *harmful*. An example for this proceeding would be those emissions from a device using the TV whitespace that fall into the band occupied by a TV channel.

The primary emission level is simply the strength of the signal that is allowed. The potential of interference from emission that do not leak out of band is not as straightforward as the OOBE interference. Due to limitations of the TV receiver, a strong signal outside the TV channel may create signals within the TV receiver within the TV channel.

The attached study, entitled “Quantifying the Impact of Unlicensed Devices on Digital TV Receivers,” quantifies the desensitization phenomenon caused by primary emissions and OOBE in order to recommend an emission limit for proposed TV band unlicensed devices that will give protection to TV receivers comparable to existing precedents. Therefore, the experiments were designed to determine what levels made past and current DTV tuners begin to show the effects of interference.

The interference study was very careful in designing the experiments. In order to insure a clear understanding of the mechanisms that cause interference, the study separated the measurements as to the impact of OOBE and primary emissions. The study used over-the-air TV signals (in this case KMCI, a Kansas public television station) and OFDM signals (6 MHz wide) to represent DTV signals and TV whitespace signals. These were used because KMCI is a DTV channel and OFDM is the primary signal modulation used by many wireless broadband devices currently and planned to be deployed (for example: WiFi – 802.11g, WiMAX – 802.16d & 802.16e). Finally, three different DTV tuners were used: a 1999 vintage set-top-box, a popular DTV TV, and a current set-top box. This does not represent an all inclusive set of tuners, but hopefully is a reasonable cross-section of devices.

Tests were performed at a single DTV signal level to represent reception close to the Grade-B contour (-68 dBm), which is considered a weak DTV signal level for a consumer grade DTV. The TV whitespace signal was placed either directly within the DTV channel being tested for interference, or it was set off by one, two or more channels above or below the 6 MHz TV channel. The TV whitespace signal was increased until it caused the TV signal to visibly degrade.

The results from the tests indicate that the newer receivers are slightly less sensitive to interference than the older receivers. This is probably not that surprising given the development of new technology. It was observed that the OOBE (out-of-band emission) levels closely follow the broadcast industry ATSC A/74 standard’s value of a 10-12 dB desired-to-undesired (D/U) ratio. That means that if the DTV signal is a weak -68 dBm, then the OOBE from the TV whitespace device at a signal level of -78 to -80 dBm begins to create interference. This can be translated to an OOBE level of -34 dBm at the TV whitespace transmitter, which is similar to the level that is needed to protect public safety narrowband systems.

The primary emission level tests addressed the levels that produced interference effects as a function of the frequency spacing from the DTV channel. The two adjacent channels are more sensitive than channels further away from the DTV channels. Again, the tests were conducted with a weak -68 dBm DTV signal. The results show that a -35 dBm signal level in either of the two adjacent channels produced a degraded picture. A stronger signal, approximately -23 dBm, is required to produce a degraded picture for anything further than one TV channel away. There is some variability in the values between the receivers. However, these values can be related back to a 100 mW (milliwatt) transmitter that is 10 meters away. **For example, if TV receivers are to be protected from an unlicensed device operating just 10 meters or more away, then**

these receivers can operate with a 100 mW transmitter power (at least) without risking a degraded picture. This is equivalent to current WiFi units, such as 802.11g routers, that are commonly used in the home.

The study authors will be pleased to provide any elaboration or additional information useful to those who may seek to replicate and verify these findings.

Respectfully Submitted,

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