MSTV

MAXIMUM SERVICE TELEVISION

Written Statement of

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On behalf of

The Association for Maximum Service Television, Inc.

Before the Committee on Commerce, Science, and Transportation of the U.S. Senate

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SUMMARY

With five decades of experience, MSTV knows how complex management of the broadcast spectrum can be, particularly during the ongoing transition to digital television. It is thus concerned by proposals to prematurely allow unlicensed devices into allegedly "vacant" broadcast channels at a time when the FCC and the world's leading industry standards body, IEEE 802.22, are still determining whether, and if so, how, new wireless services could enter the band without degrading the public's access to free, over-the-air television services. Proposals that would force the FCC to introduce unlicensed devices into the broadcast spectrum in as little as *six months* would short change the scientific discovery process, short circuit the IEEE's important work and would wrongly prejudge complicated engineering questions.

MSTV is particularly concerned given the lack of any means to prevent or even remedy interference from unlicensed devices to reception of over-the-air broadcasts or other licensed services, including wireless microphones that are used in the production of emergency news coverage, sporting events, and political conventions. For example, there is no demonstrated technology that can reliably prevent an unlicensed device from transmitting on a television channel already in use. Indeed, much vaunted "spectrum sensing" technology has never been built, tested or proven to work in the broadcast band. Moreover, reproducible laboratory studies show that harmful emissions from unlicensed devices – even when the devices operate on "vacant" channels – would cause harmful interference to licensed services.

Once unlicensed devices are in the field, broadcasters and the FCC would have no reliable means of protecting the public's television service from harmful interference. Too often, instances of interference will go unreported because consumers will not realize that an unlicensed device (or devices) has caused the interference. Even when interference is reported and linked to unlicensed devices, the FCC would not typically be able to find and shut down the interfering devices. Attempts to use traditional means to remedy harmful interference from unlicensed devices (*i.e.*, finding the offending transmitter and ordering it to cease operation) would sap both FCC and broadcaster resources, especially as the number of devices out in the field proliferates.

Even if out-of-band emissions could be controlled and the unlicensed devices could avoid transmitting on occupied channels, a fundamental problem would remain: with an *unlimited* number of unlicensed devices allowed to crowd the broadcast spectrum, the quality of broadcast and other licensed communications over that spectrum will necessarily decline. As many respected economists have recognized, this trend towards a "tragedy of the commons" would be irreversible and continually escalating.

It is also noteworthy that little white space spectrum currently exists in congested urban as well as many less populated markets. Even in rural markets where white space may be available, there is potential for interference to rural viewers, who often must use amplified antennas that would be particularly sensitive to emissions from unlicensed devices. The unlicensed devices proposal also threatens to conflict with the pending digital transition for low-power and TV translator stations, which is also a priority for rural viewers.

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Mr. Chairman and Members of the Committee, thank you for the opportunity to appear before you today to discuss policies affecting the public's spectrum resource and the important services delivered over that spectrum. My name is Robert Hubbard, and I am the President of the Hubbard Television Group, Vice President of Hubbard Broadcasting and serve as a member of the Board of Directors of the Association for Maximum Service Television, Inc. ("MSTV").

The issues surrounding spectrum management are important for this nation. Spectrum is a vital national resource, and must be managed wisely. Today there is considerable debate among economists and legal scholars regarding the best approach to spectrum management. Proponents of an unlicensed approach assert that it will lower the cost to new entrants while preventing interference to licensed services. Leading economists and legal scholars, however, have also voiced strong opposition to an unlicensed model. They believe that such an approach eliminates market discipline for entry, leading to overuse and increased interference among users. Whatever the merits or problems associated with an unlicensed approach, unique issues arise when the government attempts to employ two different regulatory regimes (*i.e.*, licensed and unlicensed) in the same band. Recent proposals would do just that, for the first time attempting to interleave an unlicensed model with licensed broadcast and other services. From an engineering and scientific perspective, the government should approach these unprecedented proposals with extreme caution.

MSTV has over five decades of practical, real world experience in spectrum management. Since 1956, we have worked to maintain and enhance the technical integrity of the American public's free, over-the-air television service as that service grew from less than 100 stations to over 1600 full-power broadcast stations. We also provided the FCC with the engineering expertise that made it possible to "squeeze in" during the transition channels for DTV service within the current 408 MHz allocation for television broadcasting. MSTV has also assisted policymakers in introducing other licensed services, including public safety communications and sophisticated Part 74 equipment essential to provide live news and sports coverage. And most recently, it helped design the process by which television broadcasters will complete the transition to digital transition ("DTV"), using the efficiency of digital technology to enable migration from the current band (channels 2 through 69) to the final condensed "in-core" band (channels 2 through 51). As a result, the television broadcast service will occupy only 294 MHz of spectrum as of 2009, in comparison to the more than 700 MHz of spectrum already available to unlicensed devices at or below the 5 GHz band.

The peaceful coexistence of so many licensed services in the same spectrum band has not happened by accident; it has required careful planning that takes into account the unique architecture of broadcast television service and the interference characteristics of the different services. Based on its knowledge of the difficulties in coordinating licensed services in the same band, MSTV is deeply concerned by proposals to allow an unlimited number of *unlicensed* devices into allegedly "vacant" channels within the spectrum reserved for the public's free, over-the-air television service. Studies and field tests conducted by well-respected scientists and engineers show that the introduction of unlicensed devices into the television broadcast spectrum threatens to create significant interference to the public's television service. As a result, the

unlicensed devices proposal would unfairly burden the over 21 million households that rely exclusively on free, over-the-air television services – a group which disproportionately includes minority, lower income, and elderly persons. In fact, these proposals threaten to create interference to approximately 73 million existing television sets that rely on an antenna to receive over-the-air television service. We are especially concerned about the interference to new digital television receivers and the government-subsidized digital-to-analog converter box program. Finally, by interfering with licensed production equipment in the broadcast bands, it would undermine coverage of emergency news, sports, political, and other events of importance to local communities. Licensed public safety services using broadcast spectrum in many major markets would also suffer.

When asked about these concerns, the relatively small but vocal group of unlicensed device advocates tells policymakers: "trust us." MSTV respectfully submits that the public's spectrum resource should be managed based on facts and engineering science, not on unsubstantiated promises. This Committee should take note of the world's leading industry standards body, IEEE 802.22, which is currently determining whether, and if so, how, new wireless services can safely be authorized to operate in the broadcast spectrum. Proposals that would force the FCC to introduce unlicensed devices into the broadcast spectrum in as little as *six months* would short change the scientific discovery process, short circuit the IEEE's important work and would wrongly prejudge complicated engineering questions. Once millions of unlicensed devices are placed into the marketplace and allowed to populate the spectrum, they cannot be removed. MSTV accordingly believes it would be unwise to place unlicensed devices into the broadcast spectrum before it is even known whether those devices can safely coexist with the important licensed services which are delivered to the public over that spectrum.

I. CONGRESS SHOULD PROTECT CONSUMERS BY PRESERVING THE TECHNICAL INTEGRITY OF THE FREE, OVER-THE-AIR TELEVISION SERVICE.

All too often, public policy debates regarding spectrum management deal with abstract concepts like "interference" and "spectrum efficiency." The impact of these proposals, however, is very real. At stake are the television sets that exist in every living room, bedroom and kitchen across America. Most television receivers have not been engineered to protect against interference from unknown, unlicensed devices operating on adjacent channels in the television band; rather, they were designed to accommodate licensed services that operate in conformity with the FCC's channel allocation plan. For the American consumer, interference from unlicensed devices is not an abstract concept. In real terms it means that the DTV set one family just purchased will not work when their neighbor turns on an unlicensed wireless device. It means that a new government-subsidized converter box will not work well when it is connected to another family's analog set.

Parties urging for the introduction of unlicensed devices into the television broadcast spectrum have argued that Congress should not be concerned with the significant interference potential of such devices because Americans can turn to pay television services for programming. These erroneous claims overlook the continued importance of over-the-air television viewing to the American consumer.

Approximately 21 million households[1] with an aggregate 45 million sets rely *solely* on free, over-the-air television.[2] Those viewers rely exclusively on over-the-air television

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[1] *Estimated Cost of Supporting Set-Top Boxes to Help Advance the DTV Transition: Testimony Before the Subcommittee on Telecommunications and the Internet, Committee on Energy and Commerce, U.S. House of Representatives*, Statement of Mark L. Goldstein, Director, Physical (continued...)

for local news, sports, weather, and entertainment. In times of emergency, their lives may be saved when local television stations disseminate critical information from government officials to members of a community, including to viewers receiving that information via portable television sets commonly used during emergencies.[3] For example, when it became evident that Hurricane Katrina was headed towards the Gulf Coast, local television stations began wall-to-wall hurricane coverage, alerting the local community about the impending dangers and urging residents, including those in New Orleans, to evacuate.[4] Once the hurricane made its devastating landfall, local broadcasters remained a key link between government officials – including the governors of Louisiana, Mississippi, and Alabama – and the public by working cooperatively and creatively to maintain an on-air presence and thereby keep both local residents and the country informed of the severe crisis that followed the hurricane.[5]

Infrastructure Issues, GAO, 7-8 (Feb. 17, 2005) (GAO Study). *See also* Comments of NAB and MSTV, MB Docket No. 04-210, *passim*, Attachment A (NAB/MSTV OTA Comments).

[2] NAB/MSTV OTA Comments at 2.

[3] Because they are typically battery powered, these sets are crucial when natural or manmade disasters leave viewers without access to power. As one report recently noted, "[I]n states in the hurricane belt … small, battery powered TVs have become must-have items to have during power outages." Satellite Business News 2, July 11, 2005.

[4] A video documenting these efforts of local television broadcasters in the Gulf Region may be viewed online at http://www.mstv.org/honoring.html ("*Gulf Region Video*").

[5] For example, after the New Orleans levees broke, WWL-TV maintained an on-air presence by relocating news operations to a broadcast facility at Louisiana State University, and later to noncommercial station WLPB in Baton Rouge. Similarly, after floodwaters overtook New Orleans station WDSU's facilities, nineteen of the station's employees relocated to Hearst-Argyle sister station WAPT in Jackson, Mississippi. WDSU's signal was then sent from Jackson to a backup TV transmitter in New Orleans, as WDSU's primary transmitter was under water. *See, e.g.*, Craig Johnson, *Hurricane Katrina Tests Broadcasters: Gulf Coast Area Stations Improvise in Order to Stay on the Air*, TV Technology, Sept. 21, 2005, *at* http://www.tvtechnology/com/features/news/n_hurricane_katrina.shtml (last visited Jan. 23, 2006).

When access to a free, over-the-air signal is curtailed by over-the-air interference in favor of a pay service, some viewers experience that loss greater than others. For example, in some markets the number of homes not connected to cable or satellite services may reach as high as 40 percent. Variations may also occur along cultural lines. Univision has reported that nationwide, 33 percent of Hispanic households receive their programming solely over the air.[6] Over-the-air viewers should not be deprived access to these critical local services merely because they do not, or cannot, subscribe to a pay television service.

Cable and satellite subscribers are also affected by loss of free, over-the-air television service. As the General Accounting Office (GAO) has reported, over ten million households that subscribe to cable have *at least* one television set that is not connected to cable.[7] Added to the sets in homes solely relying on over-the-air service, there are an estimated 73 million television sets not connected to a pay television service in the U.S.[8]

Protecting the spectral integrity of the broadcast service is particularly important as the country enters a critical stage in the transition to digital television. Congress, the Executive Branch, and the FCC have all made clear that bringing the digital transition to a successful conclusion is of utmost priority and that it should not be obstructed by lower-priority goals. Years of hard work by broadcasters, government officials, consumer electronics manufacturers, and others have seen considerable progress, with nearly all 1600 television

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[6] Comments of Univision Communications, Inc., in MB docket No. 04-210 at 8, August 11, 2004.

[7] GAO Study at 8.

[8] NAB/MSTV OTA Comments at 5.

stations in the nation's 208 television markets now broadcasting a digital signal.[9] With the transmission side of the equation – broadcast facilities – virtually complete, the critical factor is to create incentives for American consumers to turn off their analog television receivers and switch to receiving signals in a digital format by the February 17, 2009 "hard date" on which analog broadcasts are to cease. But if unlicensed devices degrade consumers' ability to receive DTV signals, adoption of digital sets will slow, undermining the DTV transition.

Concerns about the digital transition also extend to the development of an inexpensive digital-to-analog converter box that will ensure continued local broadcast service for consumers' with analog sets. (As was widely reported last year, MSTV and NAB have entered into an agreement with LG Electronics and Thomson Inc. to develop a high-quality but low-cost prototype of such a box.) In recognition of such a box's importance to concluding the digital transition, Congress has allocated $1.5 billion to subsidize consumers' purchase of converter boxes. Like any receiving device, these boxes must use antennas to receive local television signals, and therefore will be susceptible to interference, as well the analog sets to which the boxes are connected. And to meet Congressional expectations that these boxes remain low cost, there is little room to include additional filters or tuner selectivity. Even if additional funds were available, absent knowledge of the types of unlicensed services that will be operating in the band, it is difficult, if not impossible to include design changes to the box to further immunize the box from future interference.

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[9] *Mass Media Notes*, Communications Daily, Feb. 26, 2004 (quoting an NAB spokesperson as reporting 1,155 local stations on air in digital). That number has presumably risen in the nine months that have passed since NAB's report.

In light of the importance of maintaining the public's access to free, over-the-air television services both during and after the digital transition, Congress should not use the broadcast spectrum as a testbed for risky experiments in new spectrum management methods. Any proposal to introduce new untested and unlicensed wireless technologies into the broadcast spectrum must contain meaningful mechanisms to avoid interference. As discussed below, no such mechanism exists today.

II. UNLICENSED DEVICES WOULD INTERFERE WITH CONSUMER RECEPTION OF OVER-THE-AIR BROADCASTS AND OTHER LICENSED SERVICES IN THE BAND.

A. Existing Technology Would Not Prevent Unlicensed Device Operation on Occupied TV Channels.

A key, but faulty, assumption of the proposal to allow unlicensed devices to proliferate through the broadcast spectrum is that technology exists by which an unlicensed device can reliably detect when a television channel is "vacant." In fact, there is no demonstrated technology that can reliably prevent an unlicensed device from transmitting on a television channel already in use. Thus, in many circumstances, unlicensed devices would operate on channels that are already occupied by local television or other licensed services, including wireless microphones that are used in the production of emergency news coverage, sporting events, and political conventions.

Most proponents of the unlicensed devices proposal rely on "spectrum sensing" methods as the only *potentially* reliable method for protecting the public's television service from unlicensed device interference. A device using this exploratory technology would "sense" the presence of a television signal and would then, allegedly, select a channel not in use. Yet

these "spectrum sensing" technologies are wholly unproven in the broadcast context, especially in light of the uniquely open and diverse architecture of television sets.

As Motorola cautioned in public statements to the FCC concerning the unlicensed devices proposal, "It would be premature to rely on spectrum sensing until these mechanisms are shown to be reliable via comprehensive study and real-world testing."[10] Policymakers should not base real-world policy decisions on unproven promises of technology to come.

For example, efforts to develop spectrum sensing technology in the 5 GHz unlicensed band took several years of development and testing, even though in that band the task of "sensing" licensed users is far less complex than it would be in the television broadcast band. There, unlicensed devices are to be allowed to operate alongside licensed military radar through use of dynamic frequency selection ("DFS"). Development of DFS should have been relatively simple, given that a single user, the federal government, controlled both the transmission and receiving equipment for the licensed service. Indeed, prior to the FCC's decision to adopt the new rules allowing unlicensed device operation in the 5 GHz band, the National Telecommunications and Information Administration ("NTIA") had submitted detailed procedures by which these unlicensed devices would be tested to determine if they could reliably detect military radar.[11] Yet only last month, after three years of analysis and field testing, did the NTIA, Department of Defense, and the FCC reach agreement on criteria allowing sale of unlicensed devices operating alongside the military radar.

The significant efforts undertaken to permit the use of DFS in the 5 GHz band would pale in comparison to the task that would be needed to create reliable spectrum sensing

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[10] Comments of Motorola, ET Docket Nos. 04-186 and 02-380, at 8 (filed Nov. 30, 2004.

[11] *See* Comments of NTIA, ET Docket No. 03-122, at App. B (filed Oct. 1, 2003).

solutions in the television broadcast spectrum. For example, unlike military radar in the 5 GHz band, there are literally thousands of variants among the receiving equipment (*i.e.*, TV sets and Part 74 devices) at issue in the broadcast spectrum; this is a reflection of the unique open architecture of television receivers. Without reliable and consistent information about the receiving equipment, there can be no way of knowing whether an unlicensed device can detect a channel where its operation will not interfere with nearby viewers' television sets or Part 74 devices. Furthermore, in the broadcast spectrum there are full-power broadcasts, low power broadcasts, and licensed broadcast auxiliary stations (which are essential to the delivery of on-the-spot news coverage during weather disasters, public safety emergencies, political conventions, and sporting events). A spectrum sensing method would have to reliably sense *all* of these services.

Perhaps most importantly, as even Intel has recognized, in its opposition to the use of spectrum sensing spectrum for higher power unlicensed operations in the 3650 to 3700 MHz band, sensing "works well for short range, low power applications like Wi-Fi where control resides in one entity or operator-to-operator voluntary cooperation is feasible."[12] The broadcast spectrum, however, exists below 1 GHz, where propagation characteristics allow transmissions – and interference – to travel over very long distances, passing through thousands of independent locations. Indeed, proponents of the unlicensed devices proposal have made clear that they would use the broadcast spectrum to deploy very *long*-range applications.[13]

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[12] Petition for Reconsideration of Intel Corp., ET Docket No. 04-151 (filed June 10, 2005).

[13] *See, e.g.*, Comments of Microsoft Corp., ET Docket Nos. 02-380 and 04-186, at 6 (filed Nov. 30, 2004) (alleging that "some [unlicensed] WISP signals could travel over 31 kilometers" using the television broadcast spectrum).

B. Field Tests Show that Even an Unlicensed Device Operating on a Genuinely "Vacant" TV Channel Would Interfere with Viewers' Access to Local Television Services.

Even if technology were to develop that would allow unlicensed devices to properly detect when a given television channel is "vacant," significant problems would remain. In consultation with one of the most respected broadcast laboratories in North America, Communications Research Centre Canada ("CRC"), MSTV has developed and conducted a reproducible laboratory study to measure the effects on a television receiver of an unlicensed device operating on a genuinely "vacant" TV channel.[14] This study shows that harmful emissions from unlicensed devices – even when the devices operate on "vacant" channels – would seriously harm the public's access to free, over-the-air television services and would prevent the use of licensed wireless production equipment critical to the coverage of local news, sports, and other events.

Indeed, unlicensed devices operating in the broadcast spectrum at the FCC's allowed power levels for out-of-band emissions (*i.e.*, energy that an unlicensed device radiates outside of its operating channel) could prevent a viewer from watching over-the-air television even when the device is as far as *78 feet* from a digital TV set, or *450 feet* from an analog set, despite the presence of multiple walls between the device and the TV set (as would occur in multiunit dwellings). Comments filed with the FCC by parties such as Motorola and the Consumer Electronics Association have seconded these concerns about out-of-band emissions

[14] *See* Appendix A

from unlicensed devices.[15] It is noteworthy that IEEE 802.22 agrees with these concerns regarding out of band interference.

To ensure the reliability and credibility of the study, CRC and MSTV have extensively documented the methodology used and results obtained, and have submitted that documentation to the FCC.[16] MSTV subsequently produced a video, entitled "Your Neighbor's Static," which recreated the CRC/MSTV study in a real-world environment just outside Washington, D.C. Using an actual townhouse and actual DTV and analog receivers, this video showed the harmful effect of an unlicensed device operating on a "vacant" television channel on reception of over-the-air broadcasts.[17]

The CRC/MSTV field study remains the only real-world test of the effects of unlicensed devices out-of band emissions on licensed television services. The unsubstantiated promises of unlicensed device advocates cannot substitute for hard, scientific data, and this data is clear: the placement of unlicensed devices into the public's broadcast spectrum would significantly harm the public's local television service.

III. ONCE INTERFERENCE OCCURS, THERE IS NO ENFORCEMENT MECHANISM TO STOP IT.

Compounding the serious flaws described above, once unlicensed devices are in the field, broadcasters and the FCC would have no reliable means of protecting the public's television service from harmful interference. Although as a legal matter the FCC's Part 15 rules

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[15] *See* Comments of Motorola, ET Docket Nos. 04-186 and 02-380, at 12 (filed Nov. 30, 2004); Comments of CEA, ET Docket Nos. 04-186 and 02-380, at 9 (filed Nov. 30, 2004).

[16] *See* Comments of MSTV and NAB, ET Docket Nos. 02-380 and 04-186, Ex. A (filed Nov. 30, 2004).

[17] *See* Appendix B for a technical description of the demonstration.

would privilege the licensed broadcast uses over the unlicensed transmissions in an interference dispute, as a practical matter this precedence would be of little value.

Rarely will broadcasters, the FCC, or the public even be aware of harmful interference from unlicensed devices, because most cases of interference from unlicensed devices will go unreported. If unable to receive a station's signal, viewers may simply assume that the interference is caused by a problem with the broadcaster's transmission or their sets. They are more likely to change the channel, or return a new DTV set to the store, than they are to call the broadcaster. It may thus take years before anything approaching the full impact of interfering unlicensed devices on the public's access to free, over-the-air television would come to light.

Even when interference is reported and linked to unlicensed devices, the FCC would not typically be able to find and shut down the interfering devices.[18] Just as spectrum sensing technology cannot reliably *prevent* interference, it should not be relied upon to *police* it.[19] Attempts to use traditional means to remedy harmful interference from unlicensed devices (*i.e.*, finding the offending transmitter and ordering it to cease operation) would sap both FCC and broadcaster resources, especially as the number of devices out in the field proliferates. As

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[18] *See, e.g.*, *High-Tech Companies Defend FCC's Part 15 Regulatory Scheme*, FCC Report, June 14, 2002 (citing experience of amateur radio systems, which share spectrum with Wi-Fi devices, that the obligation of unlicensed devices to cease operation if they cause harmful interference to licensed operations "is an allusion.").

[19] SPTF Report, at 58 ("[O]nce unlicensed devices begin to operate . . . it may be difficult legally or politically to shut down their operations even if they begin to cause interference or otherwise limit the licensed user's flexibility."); *Review of Part 15 and Other Parts of the Commission's Rules*, 17 FCC Rcd 14063, 14067 (2002) (describing interference caused by unlicensed radar detectors to VSATs in the 11.7-12.2 GHz band, and noting that the radar detectors could not easily be identified or, even if identified, controlled).

Sprint has told the FCC, "once interfering unlicensed devices are in the market, it will ... potentially be virtually impossible for the [FCC] to recall these devices."[20]

IV. THE AGGREGATION OF UNLICENSED DEVICES IN THE BROADCAST SPECTRUM COULD ULTIMATELY LEAVE THE SPECTRUM UNUSABLE FOR ALL PARTIES.

Even if out-of-band emissions could be controlled and the unlicensed devices could avoid transmitting on occupied channels, a fundamental problem would remain: with an *unlimited* number of unlicensed devices allowed to crowd the broadcast spectrum, the quality of broadcast and other licensed communications over that spectrum will necessarily decline. Although the addition of one or two unlicensed devices in a given region may not have an appreciable effect, the addition of hundreds of thousands or millions certainly will. This trend would be irreversible and continually escalating. Maintaining a low noise floor is critical if Congress is to uphold its longstanding commitment to a robust, universal, and free over-the-air television service.

As William J. Baumol, a professor of economics at New York University, has explained in an influential 2005 paper, the "policy of unlimited entry" that is the hallmark of an unlicensed device regime "is likely to have the same detrimental effects upon spectrum usage that it has on usage of shared resources elsewhere."[21] Over time, a "tragedy of the commons" results in which the resource (*e.g.*, spectrum) is shared among so many users as to make it of little value for anyone. As Dr. Baumol notes, "interference is inevitable under a spectrum regime in which the market is not constrained by any restrictions that limit entry: in deciding whether or

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[20] Sprint Reply Comments, ET Docket No. 02-380, at 2 (filed May 22, 2003).

[21] William J. Baumol, *Toward an Evolutionary Regime for Spectrum Governance: Licensing or Unrestricted Entry?*, AEI-Brookings Joint Center for Regulatory Studies, 10 (April 2005).

not to enter, each entrant takes into account only the consequences of this decision upon himself, and disregards the effects upon others."[22] The result is "overcrowding and overuse."[23] Experience in the unlicensed 2.4 GHz band is instructive. There, cordless phones have "reap[ed] devastating effects on 802.11b WLANs" because the technologies used are not compatible for minimization of interference.[24]

Even if future technology is able to accommodate some number of additional users within a given swatch of spectrum, demand will surely keep pace and the quality of communications in the spectrum will degrade.[25] As the economist Thomas Hazlett has noted, the history of unlicensed device entry is a "chase up the dial: the 900 MHz ISM band became congested, leading the FCC to open up the 2.4 GHz unlicensed band, which became crowded in major markets, leading the FCC to open up 300 MHz for the U-NII 5 GHz band."[26] And once the decision is made to turn a band over to an infinite quantity of unlicensed devices, the spectrum cannot be recaptured for future productive use. The television broadcast spectrum should not be allowed to go the way of other spectrum that has suffered a tragedy of the commons.

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[22] *Id.* at 11.

[23] *Id.*

[24] *Interference from Cordless Phones*, Wi-Fi Planet, April 15, 2003, *available at* http://www.wi-fiplanet.com/tutorials/article.php/2191241 (last visited Nov. 21, 2004).

[25] Baumol at 11.

[26] *Id.*, *quoting* Thomas W. Hazlett, *The Wireless Craze, the Unlimited Bandwidth Myth, the Spectrum Auction Faux Pas, and the Punchline to Ronald Coase's 'Big Joke': An Essay on Airwave Allocation Policy*, 14 Harvard J. L. & Tech. 335, 429 (2001).

V. SPECTRUM IS NOT READILY AVAILABLE IN CONGESTED URBAN AND MANY OTHER MARKETS.

Driving the unlicensed devices proposal is another mistaken assumption, reflected in a paper issued by the New America Foundation ("NAF") and Free Press last year: that large swaths of television broadcast spectrum are "vacant" and thus available for use by unlicensed devices. In fact, studies demonstrate that there is little or no white space available in congested urban and even many less populated markets.[27] The benefits cited by promoters of the unlicensed devices proposal – "free[ing] up un-used capacity for innovative new wireless applications" – would thus fail to materialize in many areas throughout the country.[28]

What has caused unlicensed device advocates like NAF/Free Press to so overestimate the amount of "white space" available? Most notably, they ignore the minimal interference guidelines for determining a "vacant" channel, as proposed by the FCC in its unlicensed devices proposal in 2004 and recommended by IEEE. Once the FCC's more appropriate interference methodology is applied, most of the "white space" diminishes significantly, especially in urban and suburban areas. For example, as MSTV noted in filings before the FCC, there are very few white spaces available from Boston to Washington, DC during the digital transition. Even after the DTV transition, spectrum may be tight, because the television band will be reduced by nearly one-third. For example, in Dallas-Ft. Worth, where NAF/Free Press claims 120 MHz of television spectrum to be "vacant," only 6 MHz is actually available.

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[27] The attached Appendix C includes a study by the respected engineering firm of Meintel, Sgrignoli & Wallace concerning the scarce amount of "white space" available in many markets.

[28] *See* Comments of Wireless Unleashed, ET Docket No. 04-186, at 1 (filed Nov. 30, 2004).

Even in rural markets where some white space may be available, there is potential for interference with the existing television broadcast service. Because of their distance from transmitting towers, many rural viewers receive very weak signals. To correct this weak signal condition, rural viewers often use amplified antennas. As a result, their receiving equipment is more susceptible to interference that typical antennas. This is one reason why the National Translator Association has expressed concern about allowing unlicensed devices in rural areas.

The unlicensed devices proposal also threatens to conflict with another priority for rural viewers: the digital transition for low-power and TV translator stations, which is unlikely to be complete when full-power analog broadcasts cease in 2009. Currently, 2,100 licensed LPTV and 4,700 licensed television translator stations are eligible to "flash cut" to digital operations, and in May the FCC will open a filing window by which these stations can seek a companion digital channel. Before taking any action that may disrupt that complex transition, Congress should take notice that the rural areas into which Intel and other parties suggest unlicensed devices would be deployed depend heavily upon low power television services. As FCC Commissioner Adelstein has stated: "[t]housands of translators and low power stations across our country fill a vital need as the primary source of over-the-air television for people in Rural America. As I've seen firsthand, often these stations are the only station in an area providing local news, weather, public affairs and emergency programming."[29] Those same viewers would be deprived of digital low power television services if unlicensed devices

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[29] *Amendment of Parts 73 and 74 of the Commission's Rules to Establish Rules for Digital Low Power Television, Television Translator, and Television Booster Stations and to Amend the Rules for Digital Class A Television Stations*, 19 FCC Rcd 19331 (2004), Separate Statement of Commissioner Jonathan S. Adelstein, Approving in Part and Concurring in Part.

are prematurely introduced into the broadcast spectrum before the digital low power transition is complete.

Moreover, the broadcast industry is currently faced with a crisis over the availability of spectrum to provide live remote coverage of news and sporting events. As MSTV has noted on previous occasions, broadcasters depend heavily on wireless microphones and cameras to provide live coverage of major events.[30] Under carefully controlled and coordinated conditions, these wireless devices currently use the "vacant channels" in the UHF band to operate. However, these channels are used heavily, making it difficult in major markets to find sufficient spectrum for the proper operation of wireless microphones. As a result, broadcasters are already experiencing significant obstacles to covering events of local and national importance. The unlicensed devices proposal would put wireless microphones in conflict with unlicensed devices for scarce spectrum. Thus, operation of unlicensed devices in the broadcast band would seriously undermine local stations' ability to use existing wireless production devices and provide remote coverage of important events, including local emergencies such as weather disasters.

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On behalf of MSTV, I again with to thank the Committee for the opportunity to discuss important matters of spectrum reform and their relationship to the public's free, over-the-air television service. As demonstrated by the progress in the DTV transition, which will free up 108 MHz of spectrum for new wireless and critical public safety communications, local

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[30] *See, e.g.*, Letter from David L. Donovan, President, MSTV, to Marlene H. Dortch, Secretary, FCC, ET Docket No. 02-380 (filed June 23, 2003) (attaching transcript of video demonstrating concerns with the availability of spectrum for wireless microphones).

broadcasters are committed to efficient utilization of the public's spectrum resource. Spectrum efficiency, however, requires careful attention to the interference potential of services sharing the same spectrum band. To simply open the floodgates to unlicensed devices without resolution of the significant technical concerns described above would harm the public's interest in interference-free communications and the continued access to free, over-the-air television services. MSTV accordingly urges that any significant changes in use of the broadcast spectrum be made only *after* the FCC and respected organizations like IEEE 802.22 have designed and tested appropriate interference standards.

APPENDIX A

Laboratory Evaluation of Unlicensed Devices Interference to NTSC and ATSC DTV Systems in the UHF Band

Phase II

REPORT

by

The Communication Research Centre Canada
(CRC)

for

The Association of Maximum Service Television
(MSTV)

February 3rd, 2005

Table of Contents

Table of Contents 2

1. Introduction 3

2. Laboratory Test Set-up 3

3. Results of the Laboratory Tests 8

3.1 De-Sensitisation of DTV Receivers in Indoor Environment 8

3.2 De-Sensitisation of NTSC Receivers in an Indoor Environment 9

ANNEX 1: TEST PROCEDURE 10

ANNEX 2: LIST OF RECEIVERS 12

1. Introduction

On May 25, 2004, the FCC released a Notice of Proposed Rule Making (NPRM) that proposes to allow unlicensed radio transmitters to operate in the broadcast television spectrum at locations where that spectrum is not being used. CRC was contracted by MSTV to conduct measurements to investigate the possible impact of interference from unlicensed devices on the current DTV and NTSC services.

Based on the FCC NPRM, the proposed Unlicensed Devices (UD) "radiated emissions that fall outside the TV broadcast channel(s) where the device operates must comply with the radiated emission limits specified in § 15.209(a)". Section 15.209(a) of the FCC rules states that "*the radiated emission limits over frequency band of 215-960 MHz is 200 μV/m at a measurement distance of 3 meters*". The emission limit is based on measurement employing a CISPR quasi-peak detector with a *measurement bandwidth of 120 kHz*.

Based on the Commission proposal, CRC conducted measurement to characterise the de-sensitisation of ATSC DTV and NTSC receivers from the side-lobe radiated emissions of an unlicensed portable device. Specifically the following laboratory evaluations were performed:

- De-sensitisation of DTV receivers in an indoor environment.
- De-sensitisation of NTSC receivers in an indoor environment.

2. Laboratory Test Set-up

The Unlicensed Devices interfering emission signals were generated using a random noise generator provided by CRC. The UD emission signals were generated by CRC in such a way as to meet the FCC emission level required. (i.e. 200 μV/m, or 46 dBμV/m within a 120 kHz bandwidth). The interfering emissions signals were measured at 3 m from the unlicensed devices, within a 120 kHz bandwidth. The UD interfering emitted signal power level was adjusted to 3 dB below the FCC emission level required to avoid any impact of measurement error on the measurement results. The generated unlicensed devices interference emission signals were filtered and inserted on the desired DTV or NTSC channel. Listed below is a summary of the relevant parameters and calculations used to conduct these tests:

FCC emission limit: 200 μV/m, or 46 dBμV/m within 120 kHz

Convert to dBm:

$$P_{dBm} = -75.5 + 46 dB\mu V/m - 20\log(Freq\ in\ MHz) = -29.5 - 20\log(Freq in\ MHz)$$

Interference signal parameters:

- Random Noise filtered with a bandpass filter;
- 3-dB bandwidth: about 5% of the center frequency, or about 30 MHz;

- The top flat portion of the interference spectrum was set to 3 dB below the FCC specified limit of 200 μV/m, or 46 dBμV/m, within 120 kHz bandwidth;
- A dipole receiving antenna is assumed.

- For test in channels 24 to 26, the interfering signal level is:

  $P_{dBm} = -29.5 - 20\log(539) - 3 = -87.1\ dBm\ within\ 120kHz$

  In 6 MHz bandwidth, the calculated power is $-87.1 + 10log(6000/120) = -70.1$ dBm.

- For test in channels 52 to 54, the interfering signal level is:

  $P_{dBm} = -29.5 - 20\log(707) - 3 = -89.5\ dBm\ within\ 120kHz$

  In 6 MHz bandwidth, the calculated power is $-89.5 + 10log(6000/120) = -72.5$ dBm.

Since the interfering signal power is calculated and fed to the receiver directly, the type of antenna used for transmission and reception is irrelevant. Three types of receiving antennas are used in the tests (Silver Sensor, bow-tie and rabit-ear), the results are the same.

The interfering signal power level set up procedure:

1. At the receiving antenna output, make sure the interfering signal spectrum is relatively flat;
2. In the middle part of the spectrum (usually it is the high point of the spectrum), set the interfering power level, by adjusting emission power, to the values calculated in the equations listed above. The measurement bandwidth is 120 kHz bandwith;
3. Measure the interfering signal power in 6 MHz bandwidth for CH-25 and 53, the interfering signal power level should be 10 *log* (6000/120) = 17 dB higher than the power measured in 120 kHz bandwith, i.e., -70.1 and -72.5 dBm, respectively.
4. Use these interfering signals for the test in respective RF channels.

Our previous experience[1] showed that when the interference bandwidth is wider than about 10 kHz, the interference to DTV receiver is generally power additive (for the same interference level, the wider the band, the more impact to the DTV reception.).

In this test, bandpass filtered white noise is used rather than an OFDM signal, test and previous studies[2] showed that an OFDM signal and other digitally modulated signals behave like white noise. Laboratory tests were conducted to compare the filtered noise with an OFDM modulated 6 MHz DVB-T signal (QPSK-OFDM with 2k FFT) interfering into an ATSC DTV receiver. The DTV receiver thresholds for filtered noise and OFDM signal were measured at 15.0-15.2 dB and 14.7-15.5 dB, respectively. Several consumer grade DTV receivers were used. The difference between two interfering sources on each receiver was less than 0.3 dB.

[1] D. Prendergast, M. Guillet, B. Caron, Y. Wu, X. Wang, B. Ledoux and S. Lafleche, "The Effects of Public Safety Mobile Systems Operations (in TV channels 63/68) on DTV and NTSC Broadcasting" *IEEE Transactions on Broadcasting*, vol. 51, no. 1, pp. 43-50, March 2005.

[2] Chini, Y. Wu, M. El-Tanany, and S. Mahmoud, "Hardware Non-linearities in Digital TV Broadcasting Using OFDM Modulation", *IEEE Transactions on Broadcasting*, vol. 44, no. 1, pp. 12-21, March 1998.

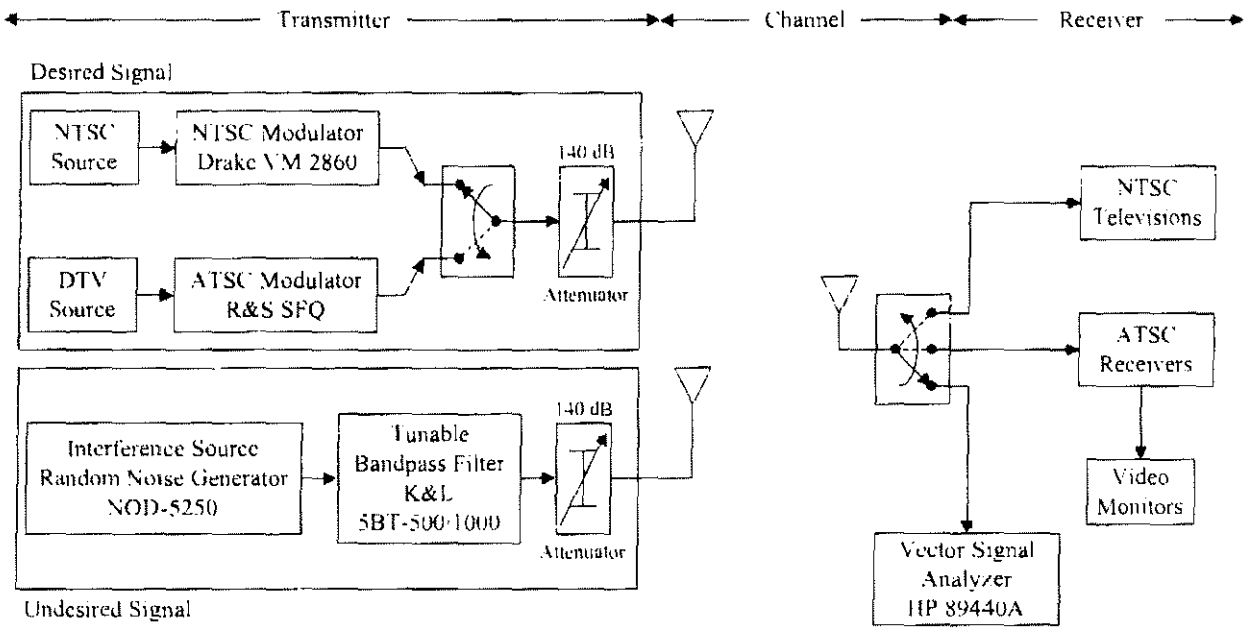

Figure 1. Laboratory Test Set-up for the Evaluation of UD Emissions Impact on TV Signals.

In the above calculation, a simple dipole receiving antenna is assumed. The emission limit field strength is converted into signal power (dBm) and is fed into the TV receivers. The correct interfering power level is adjusted by varying the transmitted power. The received power calibration is done at 3 meters from the emission source for the power levels calculated above. The interfering power level is set at 3 dB below the FCC specified level to avoid any measurement error.

The laboratory set-up for the evaluation of the ATSC 8-VSB receiver is presented in Figure 1. The set-up is divided into three sections: Transmitter, Channel and Receiver.

The laboratory measurements were conducted at a distance between the UD and the DTV or NTSC receivers of 3 meters. The resulting receiver de-sensitisation measurement was recorded. The test procedures are attached (Annex 1).

The Threshold of Visibility (TOV) was recorded when viewing DTV program over a 20 seconds period. The ITU-R Grade 3 performance (slightly annoying audio, video, and colour) for NTSC was recorded. The power levels were recorded in 1-dB step-size.

The tests were conducted using one video sequence for DTV and one video test pattern for NTSC (colour bars). The tests investigated the de-sensitisation effects due to UD interference without and with existing off-air interference.

The tests were done on Off-Air Channels 52 to 54 and 24 to 26. As a reference, Figure 2 and 3 show the off-air spectrum plot of 698-716 MHz and 530-548 MHz. It is noteworthy that there is no other source of interference detected in that spectrum band of Figure 2. However, Figure 3 shows an existing NTSC signal of -57.0 dBm peak power on channel 24.

UD interfering signals were used with a 3 dB bandwidth of about 30 MHz. The spectrums of these signals are presented in Figures 4 and 5. Based on the spectrum plots, there is little multipath distortion at a site 3 meters from the source of interference.

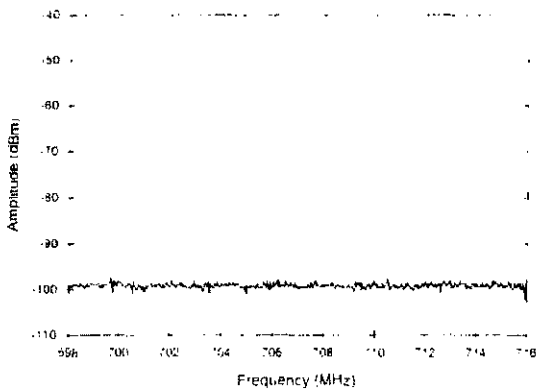

Figure 2. Off-Air Spectrum Plots of Channels 52-54 (698-716 MHz)

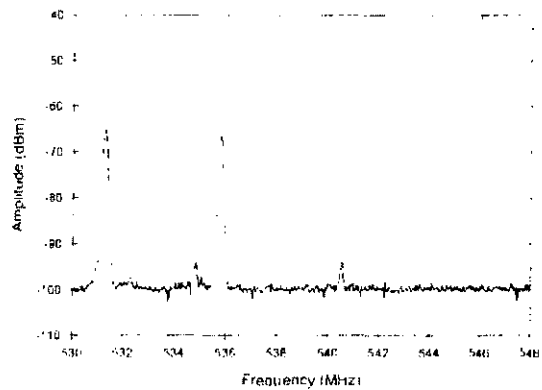

Figure 3. Off-Air Spectrum Plots of Channels 24-26 (530-548 MHz)

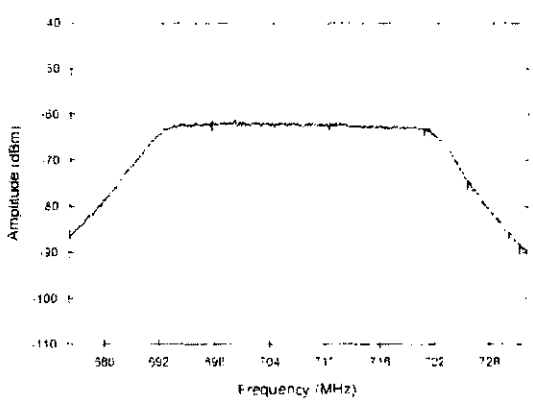

Figure 4. Spectrum of the Filtred Interfering Signal Source

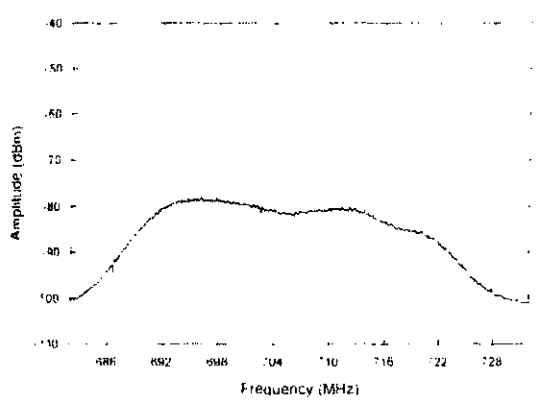

Figure 5. Spectrum of the Filtred Interfering Signal Received at 3 Meters

Note: the flat portion of the filtered interfering signal, Figure 4, is about three TV channel width.

3. Results of the Laboratory Tests

This section presents the results of the following laboratory experiments:

- De-sensitisation of DTV receiver in an indoor environment.
- De-sensitisation of NTSC receiver in an indoor environment.

De-sensitization was measured by first turning the UD off and adjusting the TV transmitted power to the minimum value required by the receiver to have reception. Then the UD was turned on and the amount by which the TV transmitted power had to be increased to have reception again was considered as the receiver desensitization. Such de-sensitization can be regarded as equivalent to the shrink in the coverage area of a transmitter because when the reception of a receiver located at the edge of the coverage area fails due to the operation of a UD, then it should be brought closer to the transmitter in order to receive stronger signal and to have reception again.

3.1 De-Sensitisation of DTV Receivers in Indoor Environment

The DTV signal and the UD sideband signals were transmitted and received in the same room. The calibration was done at a distance of 3 meters from the DTV receiver as specified by the FCC NPRM and explained in the test procedure in Annex 1. For channels 52-54, the interfering signal power was adjusted to obtain -89.5 dBm/120 kHz at 3 meters and for channels 24-26, the interfering signal power was adjusted to obtain -87.1 dBm/120 kHz at 3 meters. These interfering levels were 3 dB below the FCC specified limit.

Only one DTV receiver was used in these tests.

The tests were conducted on Off-Air channels 52-54 (698 – 716 MHz) without any external off-air interference. The tests were also conducted on Off-Air channels 24-26 (530 – 548 MHz) with an existing NTSC signal. The results are presented in Table 1 and 2.

Table 1. De-Sensitisation of DTV Receiver #1 at 3 Meters without external interference

Channel	52	53	54
Rx Sensitivity	-76.7 dBm	-78.5 dBm	-78.8 dBm
De-Sensitisation	20.5 dB	21.0 dB	21.0 dB

Table 2. De-Sensitisation of DTV Receiver #1 at 3 Meters with external interference

Channel	24*	25	26
Rx Sensitivity	-59.3 dBm	-73.3 dBm	-78.1 dBm
De-Sensitisation	9.5 dB	18.5 dB	22.5 dB

***: On CH-24, there is a dominating interference from a local off-the-air NTSC station at -57.0 dBm peak power (visual carrier). As a result, the required DTV signal level is much higher than CH-25 and 26.**

It was noticed that the receiver sensitivity varies in a +-1 dB range for different test frequencies. This maybe attributed to one or all of the following factors: multipath distortion, noise floor variation, tuner performance, and other interference mechanisms.

It was also observed that signal reflections within the building created standing wavesresulting in a received signal that could be up to 3 dB higher than what it would be for free-space propagation. There were also signal "nulls" in the room, which could result in signal level drops of several dB over small changes in location.

3.2 De-Sensitisation of NTSC Receivers in an Indoor Environment

The NTSC and the interference signals were transmitted and received in the same room. The calibration was done at 3m as explained in the test procedure in Annex 1. For channels 52-54, the interference signal power was adjusted to obtain -89.5 dBm/120 kHz at 3 meters and for channels 24-26, the interference signal power was adjusted to obtain -87.1 dBm/120 kHz at 3 meters. These interference levels are 3 dB below the FCC specified limit.

The de-sensitisation tests were carried out on Off-Air channels 52-54 (698 716 MHz) without any external off-air interference. The tests were also conducted on Off-Air channels 24-26 (530 548 MHz) with an existing NTSC signal. The results are presented in Tables 3 and 4 for tests conducted without and with external interference respectively.

Table 3. De-Sensitisation of NTSC Receiver #1 at 3 Meters without external interference

Channel	52	53	54
Rx Sensitivity	-61.0 dBm	-60.1 dBm	-62.3 dBm
De-Sensitisation	23.4 dB	23.2 dB	25.1 dB

Table 4. De-Sensitisation of NTSC Receiver #1 at 3 Meters with external interference

Channel	24*	25	26
Rx Sensitivity	N/A	-60.6 dBm	-60.0 dBm
De-Sensitisation	N/A	25.5 dB	24.6 dB

***: On CH-24, there is a dominating interference from a local off-the-air NTSC station at -57.0 dBm peak power (visual carrier). As a result, the picture quality reached CCIR Grade 3 before any interference can be injected.**

The test results show that there is more de-sensitisation for NTSC than that of DTV. This is because the NTSC system requires a higher S/N to operate.

ANNEX 1: TEST PROCEDURE

Test Procedure for Unlicensed Devices Interfering Signal Emissions into the ATSC DTV and NTSC Channel.

Set Up:

- Select an RF channel between CH14 and 69.
  - Make sure there is minimum off-air interference in co- and first adjacent channels.
- Interfering emissions signals:
  - Filtered random noise, between 18 and 35 MHz BW, about 5% of the center frequency.
- Interference signal power level set up:
  - FCC emission requirement: 200 μV/m, or 46 dBμV/m within a 120 kHz BW.
  - Convert to dBm: P(dBm) = -75.5 + dBμV/m − 20 log(Frequency in MHz) assuming dipole receiving antenna.
  - The emission signal level should be measured at 3m from the unlicensed devices, within a 120 kHz BW.
  - The signal level should be 3 dB below the above calculated emission level P(dBm) to avoid possible measurement errors. Since allowed interference signal power is calculated and fed to the receiver directly, the type of antenna used for transmission and reception is irrelevant.

- Wanted signal:
  - ATSC and NTSC.
  - TOV, for DTV, and ITU-R Grad 3, for NTSC, are used as the test threshold.
  - Test point: 3m away from the unlicensed devices.
  - Television channel multipath distortion should be minimum.

DTV TEST

Test at 3 meters with filtered random noise interference emissions signals:

- At 3m, measure the off-air interference level (co- and first adjacent-channels), and the equipment noise level in 6 MHz and in 120 kHz bandwidth;
- Adjust interfering emission signal power level, measured 3m away, to be P(dBm) − 3 dB over the 120 kHz BW;
- Turn off the interfering, transmit ATSC DTV, and find TOV, record the transmitted signal power level in 6 MHz and in 120 kHz bandwidth;
- Turn on the interference emission signal. If DTV reception is not possible, increase the DTV signal power level until TOV, record the DTV Tx signal power level in 6 MHz and 120 kHz bandwidth. The difference between the DTV signal power level with and without the interfering emission signal is the receiver de-sensitisation.

NTSC TEST

- Keep the interfering emission signal power unchanged, repeat test at 3m with NTSC as the wanted signal.
- NTSC signal power is measured as peak average power.
- CCIR Grade 3 is used as receiver threshold.

ANNEX 2: LIST OF RECEIVERS

DTV Receiver #	Manufacturer	Model Number	Serial Number	Type
1	Zenith	HD-SAT520	251-16340860	Consumer

NTSC Receiver #	Manufacturer	Model Number	Serial Number	Type
1	Sony	KV-27FX10	A 200018	Consumer

Laboratory Evaluation of Unlicensed Devices Interference to NTSC and ATSC DTV Systems in the UHF Band

REPORT

by

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November 29, 2004

Table of Contents

Table of Contents 2
Executive Summary 3
1. Introduction 4
2. Laboratory Test Set-up 4
3. Results Of The Laboratory Test 10
3.1 De-Sensitisation of DTV Receivers In An Indoor Environment 10
3.2 De-Sensitisation of DTV Receivers with UD Sideband Signals Transmitted Through A Wall 11
3.3 De-Sensitisation of NTSC Receivers in an Indoor Environment 13
3.4 De-Sensitisation of NTSC Receivers with the Narrowband Signal Transmitted Across NTSC Band 14
3.5 Cable Ingress Created by the UD Sideband Signals 15
4. Findings & Observations 16
ANNEX 1: TEST PROCEDURE 17
ANNEX 2: LIST OF RECEIVERS 19
ANNEX 3: OFFICE DRY WALL AND PHOTOS OF TEST EQUIPMENT 20

Executive Summary

This report presents the results of measurement made to assess the interference potential to DTV and NTSC television reception from the side-lobe emissions of an Unlicensed Device (UD) operating in the UHF band, which comply with the Section §15.209(a) of the FCC Rules. Section §15.209 (a) of the FCC Rules specify a radiated emission limit of 200 uV/m at a measurement distance of 3 meters over frequency range of 215-960 MHz. The emission limit is based on measurement employing a International Special Committee on Radio Interference (CISPR) quasi-peak detector with a measurement bandwidth of 120 kHz.

In general, today's ATSC DTV receiver minimum signal level is in the range of -78 dBm to -83 dBm (over 6 MHz BW), which is equivalent to a noise floor of -93 dBm to -98 dBm. Measurement results show that the proposed Unlicensed Device side-lobe emission limit will cause significant de-sensitisation to DTV and NTSC receivers over a wide area. This is because the proposed emission limit is much higher than the receiver equivalent noise floor (-60 dBm to -70 dBm over a 6 MHz BW). The level of de-sensitisation depends on the interference signal power bandwidth, distance to the interference source, receiver performance, and test environment (indoor, outdoor, etc.).

Tests were conducted in an indoor environment to determine the desensitisation to digital television reception from unlicensed device side-lobe radiated emissions in the clear and when the side-lobe radiated emissions are transmitted through a wall. The data shows that for a distance of 3 meters, an unlicensed device operating with signal bandwidths of 5.6 MHz and 0.43 MHz will de-sensitise DTV receivers an average of 24.5 dB and 13.8 dB, respectively. Similarly, at a distance of 12 meters, the average de-sensitisation is 15.2 dB and 5.6 dB respectively. At 24 meters, the average de-sensitisation is 11.4 and 4.1 dB respectively. Moreover, even when a dry wall is separating an unlicensed device and a DTV receiver, an average de-sensitisation of 19.7 dB and 15.2 dB were measured at distances 5 and 12 meters respectively, when the unlicensed device is operating with a signal bandwidth 5.6 MHz.

Similar test were also conducted for NTSC receivers. The data shows that an even greater desensitisation for NTSC, when compared to DTV. For a wideband interference signal (5.6 MHz) at 18meters from an analog television receiver, assuming ITU-R Grade 3 picture quality, the average desensitisation is 15.3 dB. For a narrowband signal (0.43 MHz), the desensitisation will depend on the location of the interference signal relative to the video and colour carrier of the NTSC signal and generally follows the traditional behaviour of the "S" curve. When placed in the middle of the TV channel, the average de-sensitisation at 18 meters is 5.6 dB. At a 6 meters distance, the desensitisation ranges from 5 dB to 18 dB depending on the location of the interference signal relative to the video and colour carrier of the NTSC signal. If the Threshold Of Visibility (TOV) is used as the picture quality threshold, a 10 dB correction (more desensitisation) should be added over the ITU-R Grade 3 case.

The UD could also cause cable ingress, especially for a single shielded RG-59 cable. The ingress level can be up to –44 dBm regardless of whether the cable is terminated or not.

1. Introduction

On May 25, 2004, the FCC released a Notice of Proposed Rule Making (NPRM) that proposes to allow unlicensed radio transmitters to operate in the broadcast television spectrum at locations where that spectrum is not being used. CRC was contracted by MSTV to conduct measurements to investigate the possible impact of interference from the unlicensed devices on the current DTV and NTSC services.

Based on the FCC NPRM, the proposed Unlicensed Devices (UD) "radiated emissions that fall outside the TV broadcast channel(s) where the device operates must comply with the radiated emission limits specified in §15.209(a)". Section 15.209(a) of the FCC rules state that "*the radiated emission limits over frequency band of 215-960 MHz is 200 dBuV/m at a measurement distance of 3 meters*". The emission limit is based on measurement employing a CISPR quasi-peak detector with a *measurement bandwidth of 120 kHz.*

Based on the Commission proposal, CRC conducted measurement to characterise the de-sensitisation of ATSC DTV and NTSC receivers from the side-lobe radiated emissions of an unlicensed portable device. Specifically the following laboratory evaluations were performed:

- De-sensitisation of DTV receivers in an indoor environment.
- De-sensitisation of DTV receivers with UD sideband signals transmitted through a dry wall.
- De-sensitisation of NTSC receivers in an indoor environment.
- De-sensitisation of NTSC receivers with the narrowband signal transmitted across the NTSC channel.
- Cable ingress created by the UD signals.

2. Laboratory Test Set-up

The Unlicensed Devices interference emissions signals were generated using a COFDM modulator provided by CRC. The UD emission signals were generated by CRC in such a way as to meet the FCC emissions requirement. (i.e. 200 uV/m, or 46 dBuV/m within a 120 kHz bandwidth). The interfering emissions signals were measured at 3 m from the unlicensed devices, within a 120 kHz bandwidth. The UD interfering emitted signal power level was adjusted to 3 dB below the FCC emission requirement to avoid any impact of measurement error on the measurement results. The generated unlicensed devices interference emission signals were up-converted, filtered and inserted on the desired DTV or NTSC channel. List below is a summary of the relevant parameters and calculations used to conduct these tests:

FCC emission limit: 200 uV/m, or 46 dBuV/m within 120 kHz

Convert to dBm: P (dBm) = –75.5 + 46 dBuV/m – 20 log(Frequency in MHz)

= -29.5 – 20 log (Frequency in MHz)

Interference signal parameters:

- Modulation: 64QAM-OFDM;
- 3-dB bandwidth: 5.57 MHz (wideband), 1.29 MHz (mediumband), 3 x 0.43 MHz, and 0.43 MHz (narrowband)
- Number of OFDM carriers: 5616, 324, 324, and 108;
- Guard interval: 1/16; 64QAM modulation.

***To avoid measurement error, the interference level is set at 3 dB below the FCC specified limit*, thus**:

- For CH-48 (677 MHz), the interference level is –29.5 – 20 log (677) – 3 = –89.1 dBm within 120 kHz.
- For CATV CH-66 (477 MHz), the interference level is –29.5 – 20 log (477) – 3 = –86.1 dBm within 120 kHz. (Note: a CATV NTSC modulator is used in the NTSC system test. CATV and off-air TV have different frequency range, but they all use the same 6 MHz NTSC signal. CATV CH-66 is equivalent to UHF off-air Channel 14 and 15.)

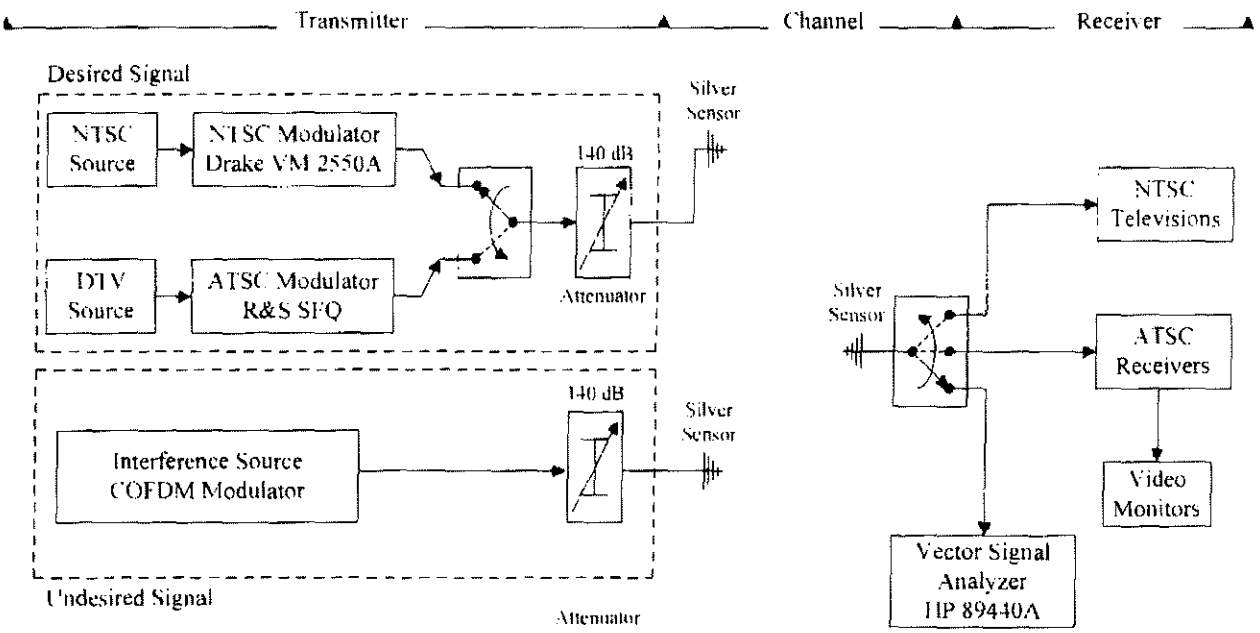


Figure 1 - Laboratory Test Set-up for the Evaluation of UD Emissions Impact on TV Signals.

In the above calculation, a simple dipole antenna is assumed. The emission limit field strength is converted into signal power (dBm). In the laboratory test, the interference power level is adjusted by varying the transmission power. The receiving power calibration is done at 3m from the emission point for the power levels calculated above.

The laboratory set-up for the evaluation of the ATSC 8-VSB receiver is presented in Figure 1. The set-up is divided into three sections: Transmitter, Channel and Receiver.

The laboratory measurements were conducted for distances between the UD and the DTV receivers of 3 m, 12 m and 24 m; for the NTSC case, the distances were 6 m and 18 m. (Note: Since the NTSC signal is more sensitive to interference, the test points for NTSC system is further away than for the DTV system). Tests were also conducted with the undesired signals transmitted through a wall (typical commercial office dry-wall) and the resulting receiver de-sensitisation measurement recorded. The test procedures are attached (Annex 1).

The Threshold of Visibility (TOV) was recorded for viewing DTV pictures over a 20 seconds period. The ITU-R Grade 3 performance (slightly annoying audio, video, colour) for NTSC was also recorded. The power levels recorded were in 1-dB step-size.

The tests were conducted using one video sequence for DTV and one video test pattern for NTSC (colour bar). The tests investigated the de-sensitisation effects due to UD interference using five different DTV receivers and three different NTSC receivers.

The tests were done on Off-Air Channel 48 (674-680 MHz) for DTV. Since only a cable TV NTSC modulator was available, the NTSC tests were performed in the 474 to 480 MHz band (CATV Channel located in the off-air Channel 14 and 15). All NTSC receivers used in the test have cable ready tuner. There are no over-the-air signals on Channel 14 and 15 in the Ottawa area where the tests were conducted.

As a reference, Figure 2 shows the off-air spectrum plots of 674-680 MHz and 474-480 MHz. It is noteworthy that there is no other interference source detected in these spectrum bands.

Four different UD interference signals were used with a 3 dB bandwidths of 5.6 MHz, 1.3 MHz, 3 x 0.43 MHz and 0.43 MHz. The spectrums of the signals are presented in Figures 3, 4, 5 and 6. Based on the spectrum plots, there is little, if any, multipath distortion at a 3m site.

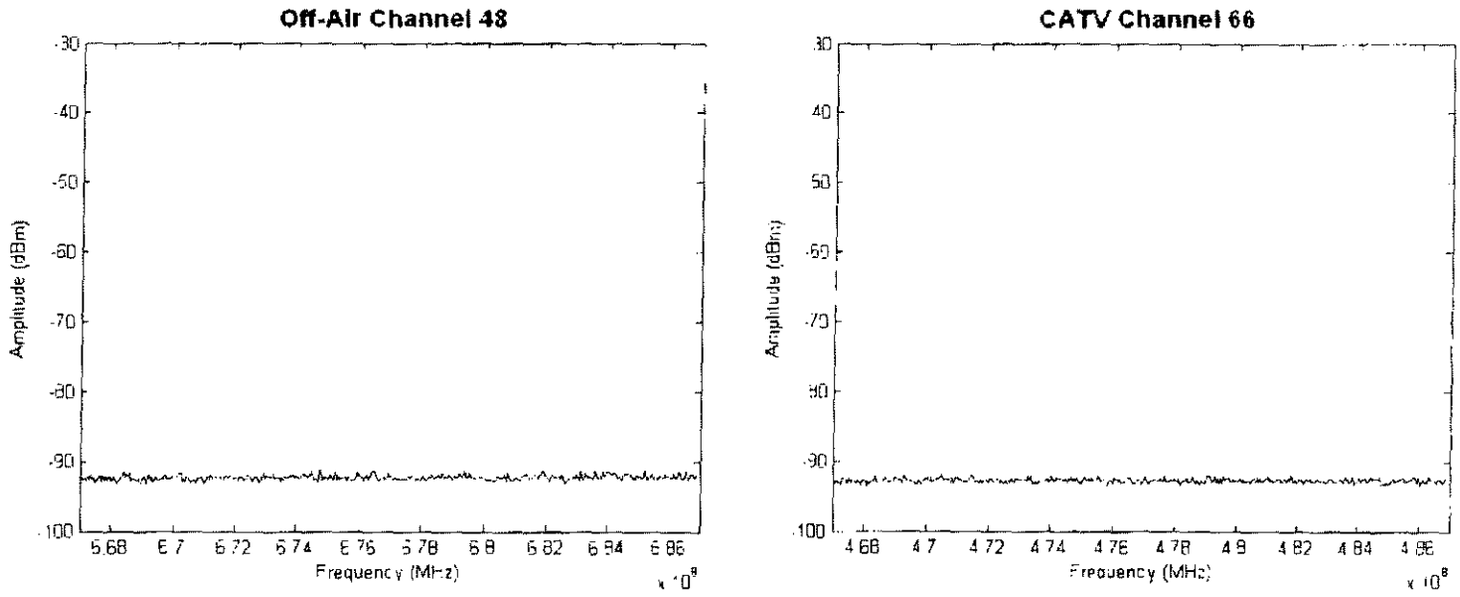


Figure 2. Off-Air Spectrum Plots of 674-680 MHz (DTV Tests) and 474-480 MHz (NTSC Tests)

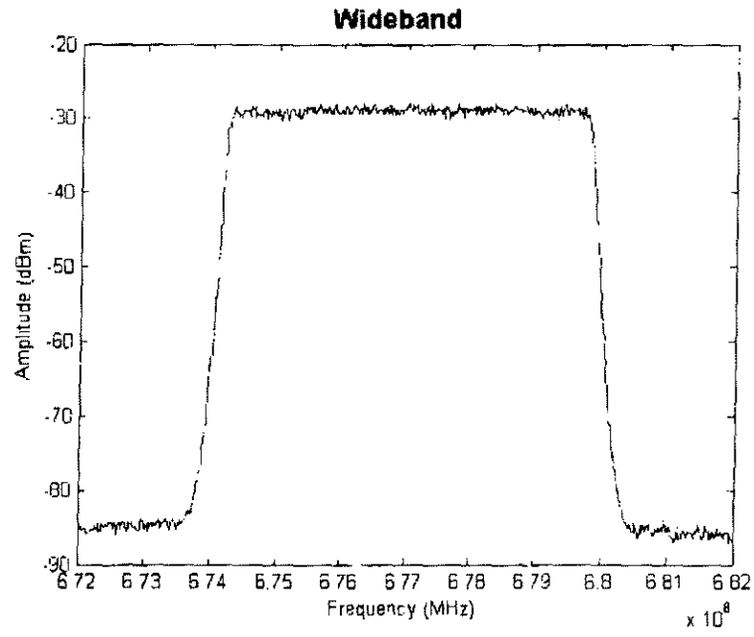


Figure 3. Spectrum of the Wideband Signal with a 3 dB Bandwidth of 5.6 MHz Received at 3 Meters.

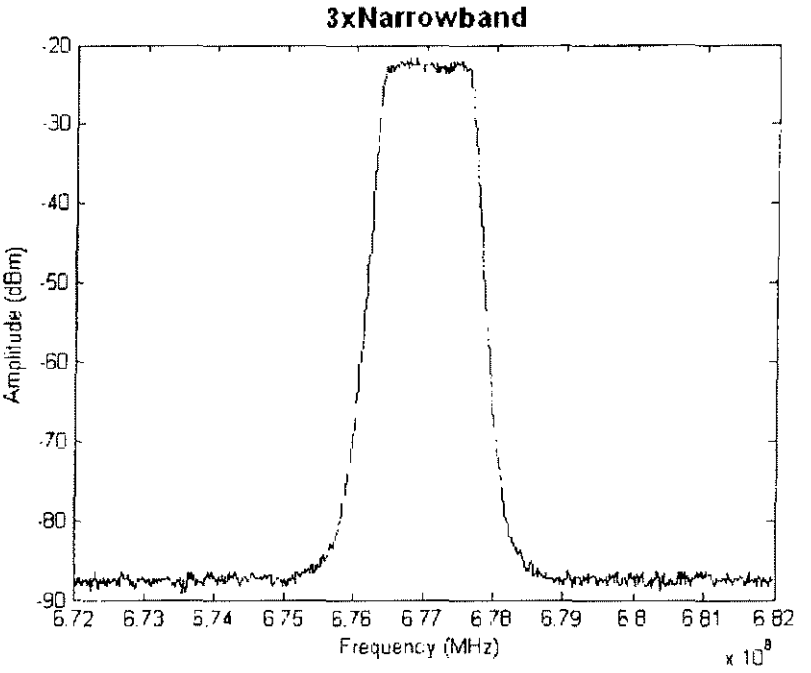


Figure 4. Spectrum of Mediumband Signals with a 3 dB Bandwidth of 1.3 MHz Received at 3 Meters.

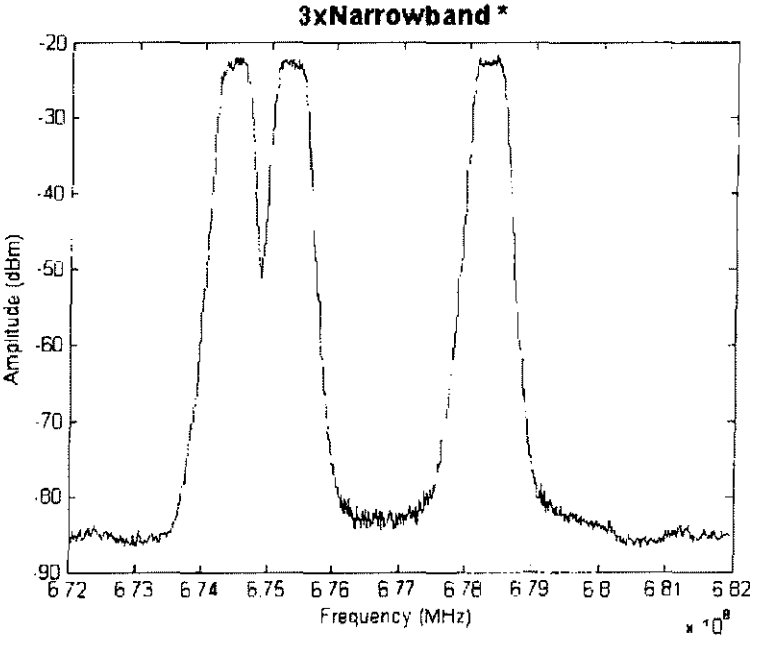


Figure 5. Spectrum of 3 x 0.43 MHz Narrowband Signals Distributed over the DTV Channel Received at 3 Meters.

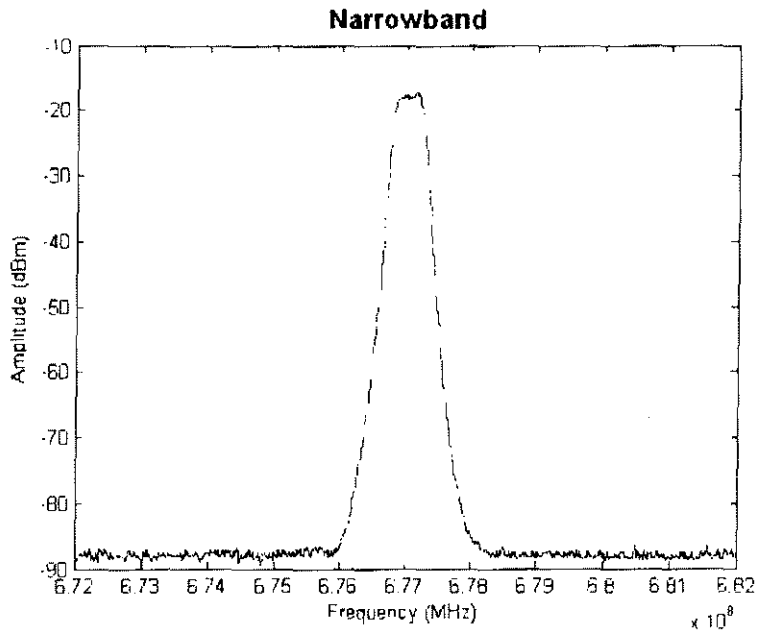


Figure 6. Spectrum of the Narrowband Signal with a 3 dB Bandwidth of 0.43 MHz Received at 3 Meters.

3. Results Of The Laboratory Test

The results of the following laboratory experiments listed below are presented in this section:

- De-sensitisation of DTV receivers in an indoor environment.
- De-sensitisation of DTV receivers with UD sideband signals transmitted through a dry wall.
- De-sensitisation of NTSC receivers in an indoor environment.
- De-sensitisation of NTSC receivers with the narrowband signal transmitted across the NTSC channel.
- Cable ingress created by the UD signals.

3.1 De-Sensitisation of DTV Receivers In An Indoor Environment

The DTV signal and the UD sideband signals were transmitted and received in the same room. The calibration was done at a distance of 3 m from the DTV receiver as specified by the FCC NPRM and explained in the test procedure in Annex 1. The interference signal power was adjusted to obtain -89.1 dBm/120 kHz at 3 meters.

For the 5.6 MHz wideband signal, the total interference power can be calculated as 89.1 + 10 log (5.6/0.12) = -72.4 dBm. For the 1.3 MHz and 3 x 0.43 MHz bandwidth signals, the total interference power is 89.1 + 10 log (1.3/0.12) = -78.8 dBm. For the 0.43 MHz narrow-band signal, the total interference power is 89.1 + 10 log (0.43/0.12) = -83.6 dBm. In all cases, the interference power levels were more than 50 dB below the recommended portable UD indoor power level at 3m reference point.

A total of five DTV receivers were used in these tests.

The tests were conducted on Off-Air channel 48 (674 - 680 MHz). The results are presented in Table 1, 2 and 3 for the tests conducted at 3 m, 12 m and 24 m respectively.

Table 1. De-Sensitisation of DTV Receivers At 3 Meters.

Off-Air Channel 48	DTV Receiver #1	DTV Receiver #2	DTV Receiver #3	DTV Receiver #4	DTV Receiver #5
Rx Sensitivity	-80.5 dBm	-81.0 dBm	-81.9 dBm	-80.6 dBm	-80.1 dBm
De-sensitisation at 3 meters					
Wideband	24.0 dB	24.3 dB	26.6 dB	24.2 dB	23.7 dB
Mediumband	17.7 dB	18.6 dB	21.7 dB	17.7 dB	16.9 dB
3 x Narrowband*	18.1 dB	18.6 dB	22.5 dB	18.3 dB	17.2 dB
Narrowband	12.7 dB	14.2 dB	17.4 dB	12.7 dB	11.9 dB

*Three 0.43 MHz carriers distributed over the 6 MHz TV channel

Table 2. De-Sensitisation of DTV Receivers At 12 Meters.

Off-Air Channel 48	DTV Receiver #1	DTV Receiver #2	DTV Receiver #3	DTV Receiver #4	DTV Receiver #5
Sensitivity	-81.3 dBm	-82.2 dBm	-84.9 dBm	-82.6 dBm	-85.0 dBm
De-sensitisation at 12 meters					
Wideband	13.6 dB	14.5 dB	15.8 dB	15.5 dB	16.4 dB
Mediumband	8.8 dB	9.2 dB	13.2 dB	9.6 dB	10.9 dB
3 x Narrowband*	7.4 dB	7.4 dB	11.7 dB	8.7 dB	9.6 dB
Narrowband	3.9 dB	4.9 dB	7.9 dB	4.9 dB	6.4 dB

*Three 0.43 MHz carriers distributed over the 6 MHz TV channel

Table 3. De-Sensitisation of DTV Receivers At 24 Meters.

Off-Air Channel 48	DTV Receiver #1	DTV Receiver #2	DTV Receiver #3	DTV Receiver #4	DTV Receiver #5
Sensitivity	-81.4 dBm	-79.2 dBm	-84.3 dBm	-83.2 dBm	-83.9 dBm
De-sensitisation at 24 meters					
Wideband	10.4 dB	8.3 dB	14.1 dB	12.1 dB	12.1 dB
Mediumband	6.9 dB	4.7 dB	11.9 dB	8.3 dB	8.9 dB
Narrowband	2.2 dB	1.4 dB	7.2 dB	4.9 dB	4.9 dB

It was noticed that the receiver sensitivity varies in a +/-1 dB range for different test points. This is attributed to one or all of these factors: multipath distortion, noise floor variation and other interference mechanisms. It was also noticed that DTV Receiver #3 always showed a higher de-sensitisation than other DTV receivers. This is attributed to Receiver 3 having a more sensitive tuner and being more susceptible to the multipath distortion (requiring a higher S/N under multipath environment).

It was also observed that signal reflection within the building created standing waves. The result of this phenomenon was that the received signal could be up to 3 dB higher than what it would be for free-space propagation. There were also signal "nulls" in the room, which could result in signal level drops of several dB over small changes in location. Moreover, multipath effects were observed to increase as the distance from the transmitter was increased.

3.2 De-Sensitisation of DTV Receivers by UD Sideband Signals Transmitted Through A Wall.

In these tests, the interference signals were transmitted through one wall before reaching the DTV receivers. The walls are typical interior office fire protective dry wall.

The calibration was done at 3 m as explained in the test procedure in Annex 1. Tests were conducted on Off-Air channel 48 (674 – 680 MHz). The interfering signal power was adjusted to be at -89.1 dBm/120 kHz at 3 meters from the receivers. The receivers tested using this interference source are listed in Annex 2.

The results of the test using the various DTV receivers each separated from the interference source by one wall such that the DTV receiver was 5 m from the interference source which was 3m from the wall are presented in Table 4.

Table 4. De-Sensitisation of DTV Receivers for Interference Signals Transmitted through One Dry Wall at a Distance of 5 Meters..

Off-Air Channel 48	DTV Receiver #1	DTV Receiver #2	DTV Receiver #3	DTV Receiver #4	DTV Receiver #5
Sensitivity	-80.2 dBm	-81.5 dBm	-82.8 dBm	-80.7 dBm	-82.7 dBm
De-sensitisation at 5 meters (1 wall)					
Wideband	18.1 dB	19.4 dB	21.6 dB	18.6 dB	20.9 dB
Mediumband	11.6 dB	12.6 dB	15.8 dB	11.9 dB	13.6 dB
Narrowband	7.6 dB	8.8 dB	12.6 dB	7.5 dB	9.1 dB

Similarly, tests were conducted at 12 m the results of which are shown in Table 5. For this case the test were conducted with and without a wall between the interference source and the DTV receivers.

The test results show that the interference signal is attenuated by about 3-6 dB, when going through a typical fire rated office drywall.

Table 5. De-Sensitisation of DTV Receivers for Interference Signals Transmitted and Not Transmitted Through One Dry Wall at a Distance of 12 Meters.

Off-Air Channel 48	DTV Receiver #1	DTV Receiver #2	DTV Receiver #3	DTV Receiver #4	DTV Receiver #5
Sensitivity	-80.8 dBm	-81.1 dBm	-82.4 dBm	-82.0 dBm	-81.1 dBm
De-sensitisation at 12 meters (No wall)					
Wideband	13.6 dB	14.6 dB	15.8 dB	15.5 dB	16.4 dB
De-sensitisation at 12 meters (1 wall)					
Wideband	11.3 dB	10.6 dB	13.1 dB	13.1 dB	11.0 dB

3.3 De-Sensitisation of NTSC Receivers in an Indoor Environment

The NTSC and the interference signals were transmitted and received in the same room. The calibration was done at 3m as explained in the test procedure in Annex 1. The interference signal power was adjusted to obtain -86.1 dBm/120 kHz at 3 meters. The lists of the NTSC receivers used in the tests are also presented in Annex 2.

The de-sensitisation tests were carried out on CATV channel 66 (474 480 MHz) equivalent to UHF off-air Channel 14 and 15. (Note: a cable TV NTSC modulator was used in the test, as an off-air NTSC modulator was not available. However, this should have no impact on the test results, since there is only a slight frequency range difference, the signal modulation is the same). The results are presented in Tables 6 and 7 for tests conducted for distance of 6m and 18m respectively. The greater than sign ">" indicates that de-sensitisation was beyond the limits of the test-bed.

Table 6. De-Sensitisation of NTSC Receivers at 6 Meters.

CATV Channel 66	NTSC Receiver #1		NTSC Receiver #2		NTSC Receiver #3	
	TOV	ITU-R Grade 3	TOV	ITU-R Grade 3	TOV	ITU-R Grade 3
Sensitivity	-51.5 dBm	-61.5 dBm	-41.5 dBm	-51.5 dBm	-45.5 dBm	-58.5 dBm
De-sensitisation at 6 meters						
Wideband	> 23 dB	26 dB	> 13 dB	14 dB	> 17 dB	21 dB
Narrowband	14 dB	15 dB	2 dB	3 dB	14 dB	14 dB

Table 7. De-Sensitisation of NTSC Receivers at 18 Meters.

CATV Channel 66	NTSC Receiver #1		NTSC Receiver #2		NTSC Receiver #3	
	TOV	ITU-R Grade 3	TOV	ITU-R Grade 3	TOV	ITU-R Grade 3
Sensitivity	-51.5 dBm	-61.5 dBm	-41.5 dBm	-51.5 dBm	-45.5 dBm	-58.5 dBm
De-sensitisation at 18 meters						
Wideband	> 8 dB	18 dB	> 4 dB	12 dB	> 7 dB	16 dB
Narrowband	8 dB	8 dB	2 dB	1 dB	7 dB	8 dB

The test results show that there is more desensitisation for NTSC than that of DTV. This is most likely because the NTSC system requires a higher S/N to operate.

The test also shows that the NTSC Receiver 2 requires 5-10 dB more power (sensitivity) than Receiver 1 and 3 for TOV and ITU-R Grade 3.

3.4 De-Sensitisation of NTSC Receivers with the Narrowband Signal Transmitted Across NTSC Band

The purpose of this test was to study the impact of a narrowband interfering signal positioned at various frequencies across the NTSC channel would have on the NTSC signal itself.

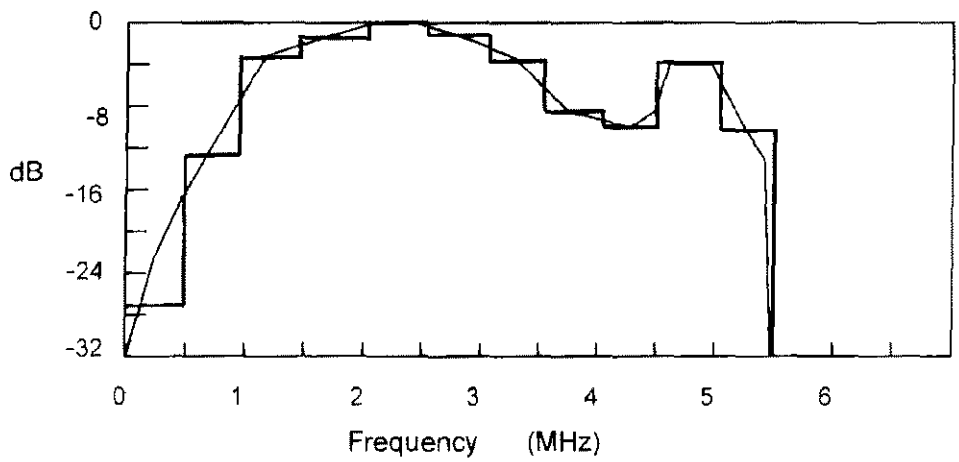
The NTSC signal and the narrowband interference signal were transmitted and received in the same room. The calibration was done at 3m as in previous cases. The interference signal power was then adjusted to obtain -86.1 dBm/120 kHz at 3 meters. The test for this case was completed with only the NTSC receiver #1 (see the list of the NTSC receivers in Annex 2).

Again, CATV Channel 66 (474 – 480 MHz), which is equivalent to UHF off-air Channels 14 and 15, was used for the test. Table 8 presents the test results at 6 m and at different frequencies across the NTSC channel. An NTSC visual signal RF subjective weighting curve shown in Figure 7 was used as reference for the interference calculation. Figure 7 shows that the NTSC visual signal is most sensitive to interference positioned between 1.5 and 2.5 MHz above the lower channel edge.

Table 8. De-Sensitisation of NTSC Receivers At 6 Meters For The Narrowband Signal Transmitted Across The NTSC Band

CATV Channel 66	NTSC Receiver #1				
	Center Frequency of the narrowband interference signal				
	474.5 MHz (at 0.5 MHz)	476 MHz (at 2.0 MHz)	477 MHz (at 3.0 MHz)	478 MHz (at 4.0 MHz)	478.75 MHz (at 4.75 MHz)
	De-sensitisation at 6 meters				
TOV	4 dB	16 dB	14 dB	14 dB	18 dB
ITUR-3	5 dB	18 dB	15 dB	15 dB	18 dB

Figure 7. NTSC Visual Signal RF Subjective Weighting Curve ("S" Curve).



The test results match well with the NTSC visual signal weighting curve ("S" curve), except at the colour sub- carrier location (about 4.75 MHz from the lower channel edge), where it is more sensitive to the interference. This is because the colour-bar test pattern, which is very sensitive to the colour sub-carrier interference, was used for the subjective assessment.

3.5 Cable Ingress Created by the UD Sideband Signals

The purpose of these tests was to determine the possible cable ingress created by the interfering signals.

For these tests, an indoor portable UD was assumed. This UD was set to transmit a 100-mW wideband signal through a Silver Sensor antenna with about 5-dB gain. The closest distance between the antenna and the cable was about 1 meter. Two types of cable were used. One being an RG-6 double shielded cable; and the other an RG-59 single shielded cable. The length of the cable used in the test was about 10 meters. The cable was stretched across a room with one end connected to a Vector signal analyser for ingress signal power measurement. Tests were conducted with the other end of the cable either terminated in its characteristic impedance or un-terminated. The results of the tests are presented in Table 9.

Table 9. Cable Ingress Created by Wideband Emission Signal.

CABLE INGRESS MEASURED POWER				
FREQUENCY	RG-6 CABLE		RG-59 CABLE	
	NOT TERMINATED	TERMINATED	NOT TERMINATED	TERMINATED
195 MHz	-46 dBm	-69 dBm	-44 dBm	-48 dBm
515 MHz	-55 dBm	-68 dBm	-44 dBm	-46 dBm

The results confirmed, as expected, that the double shielded RG-6 cable will pick up interference, if it is not terminated (in our test the un-terminated cable end is about 5m away from the transmitting antenna). RG 6 cable is probably the most widely used cable for home installation of cable TV and Satellite TV systems. For the case of the single shielded RG-59 cable, the test show that regardless of weather it is terminated or not, significant ingress interference was detected. RG 59 is often used by non-professionals to install additional cable outlet at home.

4. Findings & Observations

1. To avoid measurement errors, the interference signal level was set at 3 dB below the FCC recommended emission limit, thus, the actual receiver desensitisation could be up to 3 dB higher than the measurement results.

2. For different interfering signal bandwidth, the results are very much proportional to the interference signal bandwidth. For example, the wideband interference signal, 5.6 MHz BW, will cause 10 log (5.6/0.43) = 11.1 dB more desensitisation than a narrowband interference signal with a 0.43 MHz bandwidth. Test results show that, for each DTV receiver, the discrepancy is within +/- 1 dB over calculated results (see Table 1, 2, and 3). When desensitisation is small as shown in Table 3, the power calculation method is not accurate, since the receiver noise floor will impact the desensitisation. For example, if the interference is at the same level as the receiver noise floor, the desensitisation will be 3 dB rather than 0 dB.

3. It is interesting to note that a 1.3 MHz bandwidth interfering signal has almost the same impact as three individual 0.43 MHz (3 x 0.43 = 1.29 MHz) interference signals (+/- 1 dB accuracy) spread across a TV channel as shown in Tables 1 and 2.

4. Indoor multipath reflection forming standing waves, which results in signal peaks and nulls over few inches distance (RF frequency dependent) were observed. The peak can be 3 dB above free space propagation curve, while nulls can easily cause several dB of signal loss. The further away from the UD, the greater the potential for multipath reflection, which could cause possible desensitisation in extended areas.

5. There was more desensitisation for the case of NTSC than for that of DTV. This result is expected, since the NTSC system requires higher S/N than the DTV system to operate.

6. A narrow band interference signal located in an NTSC channel follows the behaviour of the "S" curve.

ANNEX 1: TEST PROCEDURE

Test Procedure for Unlicensed Devices Interference Signal Emissions into the ATSC DTV and NTSC Channel.

Set Up:

- Select an RF channel between CH14 and 51.
  - -Make sure there are minimum off-air interference in co- and first adjacent channels.
- Interference emissions signals:
  1. Wideband emission signal, 5.6 MHz BW
  2. Narrowband emission signal, 0.429 MHz BW
  3. Mediumband emissions signals, 1.3 MHz BW
  4. Three narrowband emissions signals distributed over the 6 MHz channel, 3x0.43 MHz
- Interference signal power level set up:
  - FCC emission requirement: 200 uV/m, or 46 dBuV/m within a 120 kHz BW.
  - Convert to dBm: P(dBm) = -75.5 + dBuV/m 20 log(Frequency in MHz)
  - The emission signal level should be measured at 3m from the unlicensed devices, within a 120 kHz BW.
  - The signal level should be 3 dB below the above calculated emission level P(dBm) to avoid possible measurement errors. Since allowed interference signal power is calculated and fed to the receiver directly, the type of antenna used for transmission and reception is irrelevant.

- Wanted signal:
  - ATSC DTV and NTSC.
  - TOV is used as the test threshold.
  - Test point: 3m, 12m and 18m away from the unlicensed devices.
  - Tests will also be done with signals transmitted thought a wall.
  - Television channel multipath distortion should be minimum.

DTV TEST

1. Test at 3m with wideband and narrowband interference emissions signals:

- At 3m, measure the off-air interference level (co- and first adjacent-channels), and the equipment noise level in 6 MHz and in 120 kHz bandwidth;
- Adjust interference emission signal power level, measured 3m away, to be P(dBm) - 3 dB over the 120 kHz BW;
- Turn off the interference, transmit ATSC DTV, and find TOV, record the transmitted signal power level in 6 MHz and in 120 kHz bandwidth;
- Turn on the interference emission signal. If DTV reception is not possible, increase the DTV signal power level until TOV, record the DTV Tx signal power level in 6 MHz and 120 kHz bandwidth. The difference between the DTV signal power level with and without the interference emission signal is the receiver de-sensitisation.

2. **Test at 12m:**

- Keep the interference emission signal power unchanged and moves the test point to 6m.
- Repeat the 3m test.
- The result will be the de-sensitisation at 6m.

3. **Test at 24m:**

- Keep the interference emission signal power unchanged and moves the test point to 24m.
- Repeat the 3m test.
- The result will be the de-sensitisation at 24m.

NTSC TEST

- Keep the interference emission signal power unchanged, repeat test at 6m, and 18m with NTSC as the wanted signal.
- For narrowband interference test, the interference emission signal should be transmitted at several in-band frequency locations across 6 MHz channel.
- NTSC signal power is measured as peak average power.

ANNEX 2: LIST OF RECEIVERS

DTV Receiver #	Type
1	Consumer
2	Professional
3	Consumer
4	Consumer
5	Consumer

NTSC Receiver #	Type
1	Consumer
2	Consumer
3	Consumer

ANNEX 3: OFFICE DRY WALL AND PHOTOS OF TEST EQUIPMENT

Figure A3-1: Office dry wall Side A (signal goes through white-board).

Figure A3-2: Office dry wall Side B (signal goes through white-board).

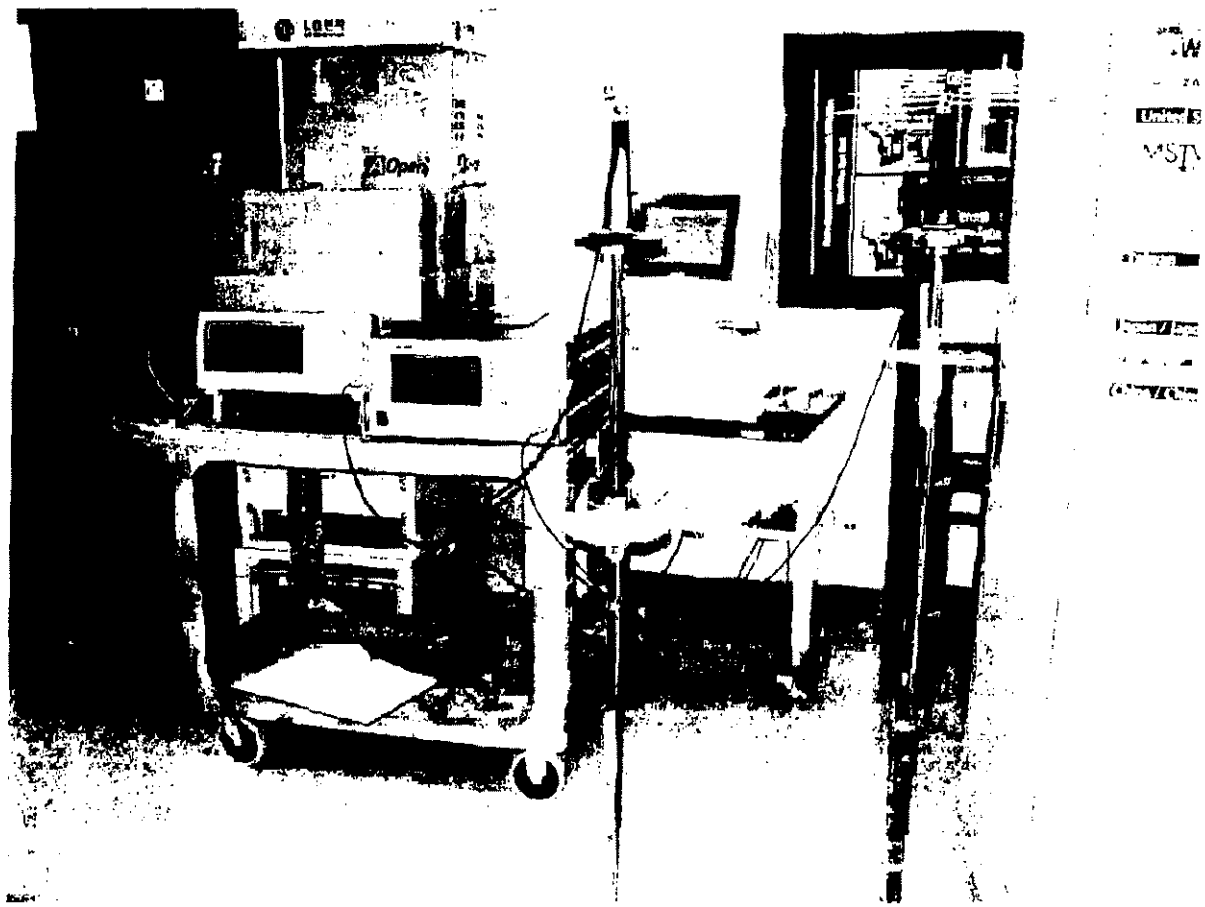


Figure A3-3: UD and DTV/NTSC Transmission Systems.

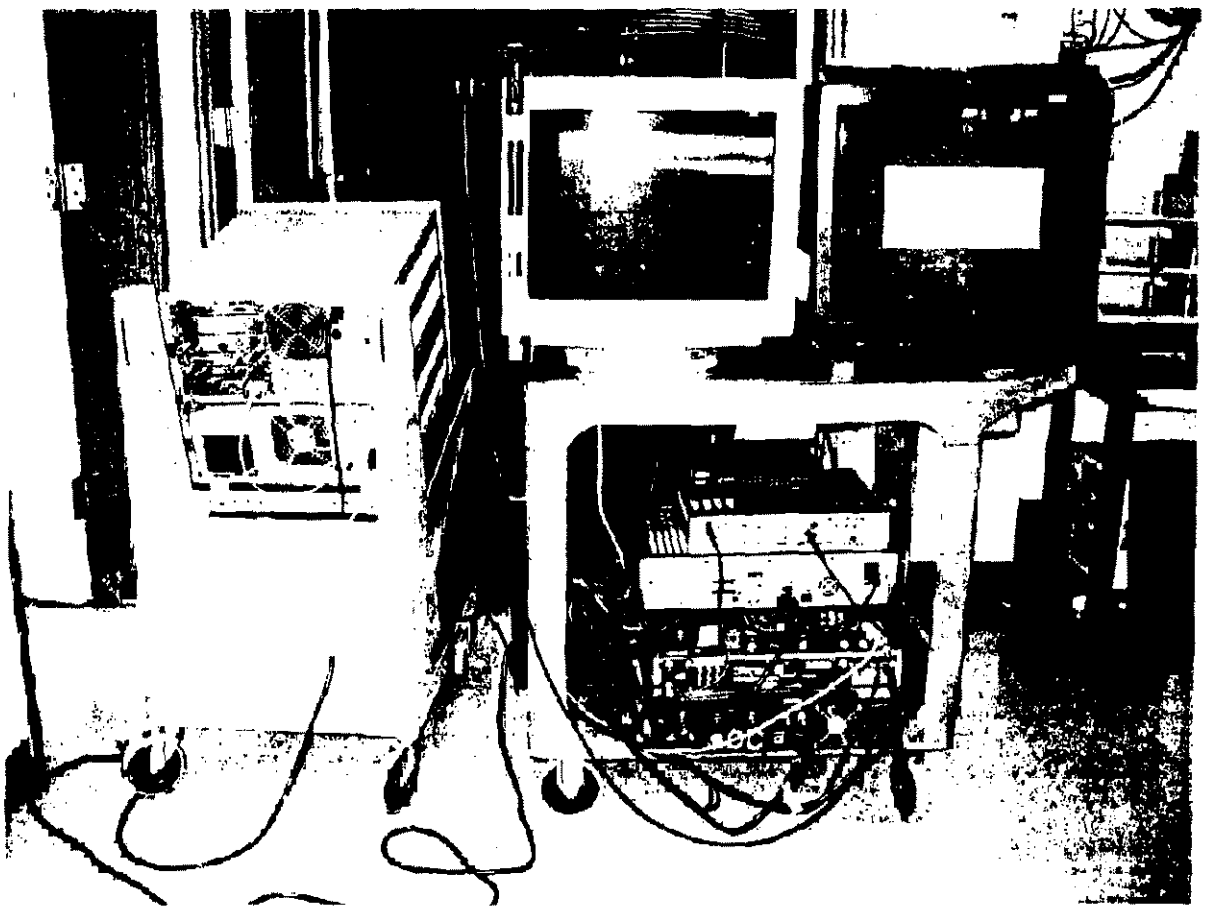


Figure A3-4: Five DTV Receivers and Reception System Set Up.

APPENDIX B

MSTV

MAXIMUM SERVICE TELEVISION

FACT SHEET

What is Out-of-Band Emission?

Out-of- band emission is the amount of energy a transmitter is allowed to radiate outside its operating channel. For example, if a transmitter is operating on TV channel 50, the out-of band emission is the amount of energy that a transmitter is allowed to radiate outside TV channel 50 and into the remaining TV band, i.e., on channels 14 through 49, and 51 through 69. Out-of-band emission is sometimes referred to as "transmitter splatter".

In the Commissions' unlicensed devices proceeding, the FCC proposed an out- of-band emission limit of 200 micro Volts per meter (uV/m) measured at a distance of 3 meters using a measurement bandwidth of 120 KHz. This means that an unlicensed transmitter operating on TV channel 50, is allowed to spill over and radiate energy on TV channels 14 through 49 and 51 through 69 as high as 200 uV/m at 3 meters calibrated for a 120 KHz bandwidth within the TV band.

What Does the MSTV Video Demonstrate?

This MSTV video demonstrates the real world devastating effect on digital television reception from an FCC compliant **out-of- band emission that would be generated** by an unlicensed device operating on vacant TV channels. The MSTV video does not demonstrate the operation of an unlicensed device in the TV band, since such a device has not been yet invented. It does, however, demonstrate the effect of the proposed FCC limits for out-of-band emission if an unlicensed transmitter is eventually built. Interference from an unlicensed device transmission operating on the same TV channel as a TV station is not considered in this video.

How Does Out-of-Band Emission Affect TV Reception?

Television receivers cannot differentiate between energy generated from the out-of-band emission of an unlicensed device or its own television signal. The energy splatter radiated from an unlicensed transmitter, if strong enough or located too close to a TV receiver, could prevent TV reception. To illustrate this point, one could compare out-of band emission to background music. If the source of the background music is to close to an individual ear, the individual will have a difficult time listening to someone speaking in the same room, even if that person is speaking in a very loud voice. The ear, like a TV receiver, reaches a level where the music interferes with its ability to hear a conversation. Among the factors in determining whether the conversation is disrupted are where the source of the music is in relation to the ear

and the loudness of the conversation. The MSTV video effectively demonstrates that point. Specifically, when an unlicensed device out-of- band emission is too high (i.e., the music is too loud), it will interfere with TV reception even though the unlicensed device is transmitting from different rooms in the same house where the TV set is located, or even from the house next door.

How Did MSTV Generate the Out-of-Band Emission in the Video?

MSTV used commercially available devices to generate energy equivalent of the 200 uV/m at 3 meters for every 120 KHz bandwith segment. These devices, known as "noise generators", are capable of generating the out-of-band energy level specified by the FCC over a span of only three television channels, not the whole TV band. For example, one device can generate out-of-band emission for every 120 KHz segment over a span of TV channels 48, 49 and 50, another device can be used to generate out-of-band emission on TV channels 14, 15, 16 or the same device could be retuned to generate out-of-band emission on these lower channels, etc. Description of the science behind the demonstration and how these devices were calibrated explained in the attached documents by Meintel, Sgrignoli & Wallace, and the Communications Research Center of Canada, an agency of Industry Canada.

Meintel, Sgrignoli, & Wallace

Procedure for Unlicensed Device Demonstration

At the request of the Association for Maximum Service Television, the firm of Meintel, Sgrignoli, & Wallace (MSW) conducted a demonstration of the potential interference from an unlicensed device operating in the television bands, as proposed by the FCC NPRM. This demonstration, conducted in a town-home located in Alexandria, Virginia, showed that under the current proposed rules, unlicensed devices cause interference to existing television reception. The following procedures were utilized for the demonstration.

Based upon the FCC NPRM, the proposed unlicensed devices would comply with FCC Rules specified in Section 15.209(a). Section 15.209(a) states that "the radiated emission limits over frequency band 215-960 MHz is 200 dBμV/m at a measurement distance of 3 meters." The emission limit is based on measurement employing a CISPR quasi-peak detector with a measurement bandwidth of 120KHz.

To conduct the demonstration MSW utilized a random noise generator connected to a band pass filter with a vertical whip antenna. In the demonstration, MSW set the output of the device to meet FCC emission requirements (i.e. 200 dBμV/m, or 46 dBμV/m within a 120 KHz measurement bandwidth). The output level of the device was set 3dB below the FCC emission requirement to avoid any impact of measurement error on the results. The methodology used is identical to the one used by the Communications Research Center of Canada (CRC) for their laboratory evaluation. Details of the laboratory evaluation is described in the two attached reports (Attachment A)

FCC Emission Limit: 200 dBμV/m, or 46 dBμV/m within 120 KHz.

Convert to dBm: P dBm = -75.5 + 46 dBuV/m -20 log(Frequency in MHz)
P dBm = -29.5 – 20 log(Frequency in MHz)

Interference Signal Parameters:

- Random Noise filter with a Bandpass Filter
- 3-dB Bandwidth = 30 MHz
- Vertical Whip Antenna used for the Unlicensed Device
- To avoid measurement error, the output was set 3dB below the FCC Limit

For example, for Channel 50 the interference level is:

P dBm = -29.5 – 20 log (689) – 3
P dBm = -89.26 dBm (within 120 KHz)

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The table below shows the emission limits that were set for each channel tested.

Channel	Center Frequency of Channel	Emission Limit for Demonstration
14	473 MHz	-85.99 dBm
15	479 MHz	-86.11 dBm
26	545 MHz	-87.23 dBm
27	551 MHz	-87.32 dBm
34	593 MHz	-87.96 dBm
36	605 MHz	-88.14 dBm
48	677 MHz	-89.11 dBm
50	689 MHz	-89.26 dBm
51	695 MHz	-89.34 dBm

The setup of the demonstration involves a careful calibration of the transmitter system to ensure that the fields are set correctly for each channel at the prescribed 3 meters distance. To calibrate the output level for each channel, the unit was turned on with the band pass filter centered on the desired channel and the UHF vertical whip antenna connected (as shown in Figure 1). A calibrated dipole antenna (NIST Traceable) set for the appropriate frequency was then placed at the prescribed 3 meters distance and oriented in the vertical plane. Then, using a calibrated coaxial cable (measured loss cable) the output level of the transmitter was adjusted to achieve the appropriate power level as measured with a 120 KHz bandpower marker on a vector signal analyzer. (see attached CRC reports for further description)

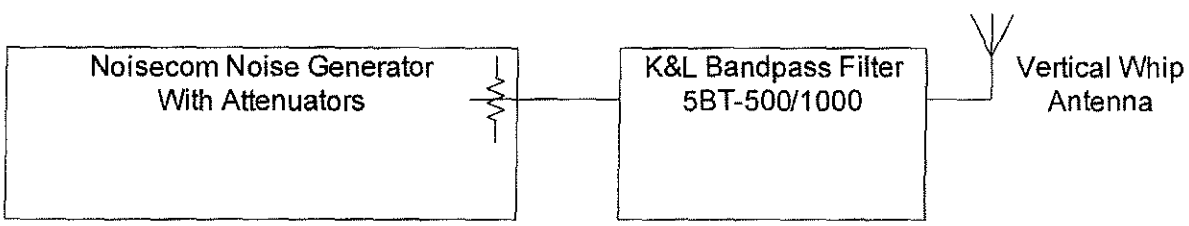

Figure 1

As shown in figure 2, the signal level was measured using a vertically oriented calibrated dipole at a distance of 3 meters. Accounting for the loss of the coaxial cable, the signal power within 120 KHz was measured on a vector signal analyzer.

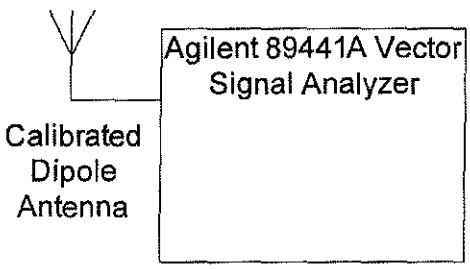

Figure 2

Once the calibration of the power level is set, the device is placed in various rooms of the subject townhome for the experiment. The setup is as shown in Figure 3. The transmitter can be cycle on and off to show the added impairment to both the analog and digital television reception within the home as well as from the adjacent dwelling unit. The desired signal for the TV receiver is the off-air reception of the local Washington, DC area analog and digital television stations. By using real-world television signals, the detrimental effects of the transmitter can be seen on over the air reception using rabbit ears and small indoor antennas. Without the introduced interference, the home receives very good quality analog and digital television signals.

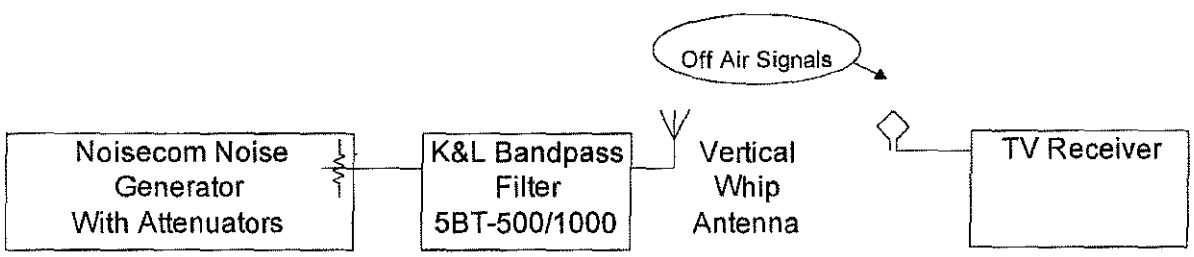

Figure 3

MSTV
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Rebuttal of The New America Foundation Critique of MSTV's " Your Neighbor's Static" Video

The New America Foundations' criticism[1] of the Association for Maximum Service Television's video, "Your Neighbor's Static" was based on the following three points:

a. ***"MSTV did not include details to show how an independent observer could reproduce its results"***

MSTV's Response: The MSTV video is based on the MSTV original submission to the FCC in its Unlicensed Device Proceeding. The video mentioned the laboratory work of the Communications Research Center (CRC) of Canada, which is the basis for the MSTV video demonstration. The CRC work shows in the laboratory that out-of-band emission generated from an unlicensed device transmitter will cause interference up to 78 feet from a TV set. Specifically, the CRC study describes the equipment used, how the out-of-band emission signals were generated and how the interference numbers were calculated as well as the impact of the out-of-band emission has on three different generations of DTV and NTSC receivers. The MSTV video was created simply to collaborate the laboratory work in the field, using real live TV transmission and actual settings for operating these devices. Note that MSTV selected CRC to conduct the laboratory work since they were deemed to be knowledgeable and credible in modeling both broadcast and wireless interference[2].

b. "Informal discussions with an individual involved with the production reveal that the simulated unlicensed device exploited a longstanding loophole in the FCC Rules that has never caused a problem using real transmitters" and ***"..the device demonstrated is reported to be 54-MHz wide noise generator.."*** **and** ***"..this device will be normally forbidden by the FCC proposed rules, but a loophole permits it to be used in the***

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[1] The criticism of the MSTV video tape is described in Section III of a document by the New America Foundation entitled " Reclaiming the Vast Wasteland: Why Unlicensed use of the White Space in the TV Bands will not Cause Interference to DTV viewers", authored by Michael J. Marcus, Paul Kolodzy and Andrew Lipman.

[2] CRC submitted a study on behalf of Intel, Inc. to determine the necessary parameters relating to co-channel and adjacent channel interference from wireless devices in the TV bands.

existing unlicensed band in conjunction with a more powerful signal limited to 6 MHz."

MSTV's Response: The information reported by NAF is false and does not represent the actual video demonstration parameters. MSTV's video did not exploit "a long standing loophole in the FCC Rules." The MSTV tests merely demonstrated the significant interference impact that signals at the out-of -band emission level contained in Part 15 and proposed for unlicensed devices in the broadcast band would have on TV reception. If NAF is confused as to why "this has never caused a problem using real transmitters," the answer is quite simple. To date, Part 15 transmitting devices have not been allowed to operate in the broadcast television band.

NAF also claims that the device demonstrated by MSTV was a 54 MHz white noise generator. This is also false and misleading. The device used by MSTV in the demonstration generated out-of-band signals on only 18 MHz of spectrum not the 54 MHz purported by NAF. Given that the proposed unlicensed device is for "broadband" operations, we believe that it is not unreasonable that out-of-band emissions would be generated across such a bandwidth. Further, the device actually operated below the permitted FCC limit. In fact, the MSTV device was calibrated to generate a signal equivalent to **3dB LESS than the FCC limit of 200 uV at 3 meters for a NARROW bandwidth of 120 kHz wide. This is not only the methodology specified by the FCC to measure out-of-band emissions but it is also approved internationally by the International Special Committee on Radio Interference (CISPR).** Moreover, the out-of-band emission problem highlighted by MSTV was independently studied by a working group[3] of the 802 IEEE Wireless Society, (IEEE-802.22), and tentatively determined that the FCC out-of-band limits are insufficient to protect DTV receivers by some 33 dB.

MSTV's work is based on good science, well-established scientific methodology and sound engineering practice. NAF criticism is based on perceived FCC loopholes, hearsay and unlicensed transmitters not yet invented or proven to work.

c. ***"The FCC rules were written two decades ago when instrumentation was less advanced than it is today..."*** and ***" ..this loophole in the Part 15 unlicensed rules, which would theoretically permit emissions in the TV***

[3] The IEEE 802.22 is the Working Group responsible for developing standards for operating Wireless RANs within the TV bands. In September 2005, the Working Group filed an exparte filing with the FCC to report on its activities and findings to date. The Report concluded that unlicensed systems should not operate within a co- and first adjacent channel contour of a DTV station and that the out-of-band emission are insufficient to protect DTV receivers for 2nd adjacent channels and beyond by some 33 dB for 1 dB desensitization of DTV receivers.

band can be closed once the FCC includes it in its Reports and Order in this proceeding an additional easily-measured total limit on power in the TV bands for out-of-band emissions."

MSTV's Response: The out-of-band emission rules specified in the FCC rules are independent of the instrumentation used to measure them. Basically, The FCC rules only define three parameters: a field strength level (200 uV/m at 3 meters); a bandwidth (120 kHz); and, a specific measurement methodology (the CISPR standard) to insure compliance with the out-of-band limits. It does not specify the instrumentation that should be used to measure these limits. Advances in measurement instrumentation will not change the values specified by the FCC for out-of-band emission.

MSTV and others have shown that the proposed FCC out-of-band emission limits are inadequate and do cause unacceptable interference to TV receivers. Changes in the instrumentation will not change that fact. Moreover, NAF did not propose an alternate measurement technique to either the FCC or the scientific community to replace the current technique or deal with the perceived loophole for evaluation and peer review. It left that task to the FCC. Changes in the FCC Part 15 Standards impact many products, and incumbent users. It is, therefore, imperative that such an undertaking be properly evaluated and accepted by the scientific and international community before FCC adoption.

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c. ***"The FCC rules were written two decades ago when instrumentation was less advanced than it is today..."*** and ***" ..this loophole in the Part 15 unlicensed rules, which would theoretically permit emissions in the TV band can be closed once the FCC includes it in its Reports and Order in this proceeding an additional easily-measured total limit on power in the TV bands for out-of-band emissions."***

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APPENDIX C

Meintel, Sgrignoli, & Wallace

Critique of The Free Press Study Measuring the TV "White Space" Available for Unlicensed Wireless Broadband

At the request of the Association for Maximum Service Television, the firm of Meintel, Sgrignoli, & Wallace (MSW) conducted an analysis of the study entitled " Measuring the TV White Space Available for Unlicensed Wireless Broadband" published jointly by Free Press and the New America Foundation. The MSW analysis encompassed an evaluation of the Free Press methodology and findings and attempted to correct the deficiencies in the Free Press study to more appropriately reflect the post-DTV-transition spectrum availability.[1]

Our analysis concluded that the Free Press study is *deeply flawed*. It *grossly overestimates* the amount of spectrum available in the 22 markets listed in the study. Moreover, the Study *lacks a defined methodology* and *ignores well- established interference protection criteria* proposed by IEEE and the Federal Communications Commission to protect the incumbents -- over-the-air television viewers and Private Land Mobile Service (PLMRS) users. In summary, the Free Press study is an incomplete, inaccurate and over-simplistic attempt at assessing the availability of "white space" for unlicensed wireless broadband in the TV band.

Listed below is a summary of the shortcomings associated with the Free Press study.

A. *The Freepress Study Lacks a Defined Methodology*:

- The study does not define or specify the area within a given market where a channel is available for unlicensed operation. (I.e. whether a channel is available for unlicensed use within one mile, 10, 20 or 30 miles from a market)

- It does not specify the unlicensed device technical parameters or network configuration that were used to determine whether a channel is available for use in a given market.

[1] The authors conducted a study of spectrum availability for unlicensed operation during the transition. The study concluded that, using the FCC proposed parameters for protecting TV reception, little if any TV channels are available for unlicensed operation within the TV broadcast bands within the major metropolitan areas of the United States. (*See Joint MSTV/NAB Comments in ET Docket No. 04-186, November 2004)*

P. O. Box 907 Warrenton, VA 20188
Phone 540-428-2308 Fax 540-428-2309

- It does not specify the interference criteria used to protect television viewers or Private Land Mobile Radio Services (PLMRS) users. Specifying the protection criteria is essential when determining whether a channel is available for unlicensed use in a given market.

- It does not use a single, official database source to determine TV channel assignments or PLMRS use. Rather, it lists a number of databases such as CEA antenna web, Public Integrity's Media Tracker, REC net, etc. to come up with an aggregate and selective database that is nearly impossible to duplicate or validate.

B. ***The Free Press Study Ignores Interference Protection for Incumbents***

- The Study allows unlicensed wireless operation within the service area of an adjacent channel of a high power, low power and Class A station or translator. Allowing unlicensed operation within the service area of an adjacent television channel is inconsistent with the proposed interference/protection guidelines proposed by the FCC and the IEEE Wireless Committee P802.22 on Wireless Regional Area Network (WRAN)[2]. Ignoring the adjacent channel protection will grossly overestimate the availability of spectrum for unlicensed wireless operation.

- It allows unlicensed wireless operation within the service area of an adjacent PLMRS operation. Allowing unlicensed operation on the adjacent channel of a PLMRS service is inconsistent with the proposed FCC protection guidelines afforded for land mobile operation. Specifically, the Commission in ET Docket 04-186 proposed restricting operation of unlicensed devices within 131 km from adjacent channel operation in the metropolitan markets where PLMRS operations are authorized. Again, ignoring the adjacent channel protection will overestimate the availability of spectrum for unlicensed wireless operation in markets where PLMRS are authorized to operate.

- It allows unlicensed wireless operation on TV channels 2, 3, and 4. Operation of unlicensed wireless devices on these channels is inconsistent with the proposed FCC band plan in ET Docket 04-186. Specifically, the Commission

[2] The IEEE 802.22 is the Working Group responsible for developing standards for operating Wireless RAN's within the TV bands. In September 2005, the Working Group filed an ex parte filing with the FCC to report on its activities and findings to date. The Report concluded that unlicensed systems should not operate within a co- and first adjacent channel contour of a DTV station.

P. O. Box 907 Warrenton, VA 20188
Phone 540-428-2308 Fax 540-428-2309

proposed limiting unlicensed wireless operation to channels 5 through 51 to protect a wide variety of consumer products that use these channels. Again, allowing unlicensed wireless operations on TV channels 2, 3, and 4 will overestimate the availability of spectrum for unlicensed wireless operations.

C. The Free Press Study is Incomplete and Inaccurate

- Disparate and apparent inconsistent treatment of LPTV's, Class A and translators from market to market.
- The Free Press Study ignores the fact that translators generally require two TV channels to operate. The first channel is the input channel where the TV program is relayed to the translator; the second is the channel the translator is transmitting the program to its viewers. The Study only affords protection to a single channel.

While MSW does not support the approach used in the Free Press study, an attempt was made to correct the deficiencies specified above and recreate the study with the corrected parameters to assess its impact on the availability of spectrum for unlicensed wireless broadband in these markets.

Listed below are the remedies used to correct these deficiencies:

Defined Methodology and Interference Protection for Incumbents:

- The area where a channel is available for unlicensed operation was set at 20 miles from the city center of a market. The range selected is consistent with the ongoing activities in IEEE 802.22, which specify the proposed range of these WRAN systems should be 33 km (approximately 20 miles).

- The technical parameters are the same as the FCC proposed in Docket 04-186 and used by IEEE 802.22 in its WRAN Requirement document[3]. A base

[3] *See IEEE 802 LAN/MAN Standards Committee 802.22 WG on WRAN's (Wireless Regional Area Networks)* **Requirements Document and Channel Model** (document numbers 22-05-0007-46-0000 and 22-05-0055-07-00 respectively)

P. O. Box 907 Warrenton, VA 20188
Phone 540-428-2308 Fax 540-428-2309

station or Customer Premises Equipment (CPE) is limited to a maximum Effective Radiated Power (ERP) of 4 watts.

- The interference protection afforded for television stations when an unlicensed WRAN system is operating on their first adjacent channel is based on the IEEE 802.22 Ex parte filing with the FCC (see footnote 2). It specifically states WRAN systems should **NOT** operate within the first adjacent protected contour of a digital television station. Outside the station contour, the interference protection used is the proposed protection in ET Docket 04-186.

- The official database used to conduct the analysis is the FCC database. Specifically, the database used here was extracted from the FCC's CDBS data on November 1, 2005.

- The protection criteria used for PLMRS is the same as proposed by the FCC ET Docket 04-186. Specifically, the Commission limited unlicensed operation with 134 km and 131 km from a co- and adjacent channel operation respectively in markets where PLMRS are authorized.

- Operation of unlicensed systems on TV channels 2, 3 and 4 were excluded. This exclusion is consistent with the proposed operation of unlicensed devices in Docket 04-1886.

- The methodology assumes that post-transition, Class A and low power television stations and translators will flash cut and operate on their NTSC channel.

- The methodology also assumes that post-transition, any stations that currently are on out-of-core (channels 2-51) will move into the core as required by the FCC.

The Table A below shows the resulting spectrum availability when these corrections are applied to the Free Press study. Specifically, the table lists the spectrum availability identified in the Free Press study along with the MSW findings after correcting the deficiencies in the Free Press study. Note that the Free Press study grossly overestimated the amount of spectrum available in these markets. Appendix A contains the corrected analysis for each market.

P. O. Box 907 Warrenton, VA 20188
Phone 540-428-2308 Fax 540-428-2309

Table A

Corrected Spectrum Availability

TV Station Ranking	City	State	Available Spectrum Free Press	Available Spectrum MSW
3	Philadelphia/Trenton	PA	90	**0**
5	Boston	MA	114	**0**
5	Manchester	NH	138	**24**
6	San Francisco	CA	114	**0**
7	Dallas- FT Worth	TX	120	**6**
13	Seattle	WA	156	**30**
14	Phoenix	AZ	132	**42**
23	Portland	OR	174	**60**
48	Las Vegas	NV	156	**0**
57	Little Rock	AR	180	**84**
60	Richmond	VA	192	**78**
62	Charleston	WV	216	**48**
74	Portland	ME	198	**112**
75	Omaha	NE	156	**54**
83	Columbia	SC	210	**66**
89	Jackson	MS	180	**48**
96	Baton Rouge	LA	132	**0**
109	Tallahassee	FL	192	**78**
112	Reno	NV	162	**0**
118	Fargo	ND	246	**156**
206	Helena	ND	186	**84**
207	Juneau	AK	222	**174**

As stated earlier, MSW does not support the approach used by Free Press and believes that the methodology used in the MSTV filing with the Commission in Docket 04-186 is a more precise technique to assess the availability of "white space" in a given market or region. The study originally conducted by TechWare, Inc. (now MSW) uses the same propagation curves (FCC broadcast curves) proposed in the FCC Docket to compute the field strengths for both the desired and the undesired signals to identify the areas where the unlicensed broadband transmitters could be placed. The study modeled a grid of fixed, unlicensed transmitters representing a network of unlicensed devices that was superimposed at different geographic

P. O. Box 907 Warrenton, VA 20188
Phone 540-428-2308 Fax 540-428-2309

regions within the US to determine the number of vacant channels available at these locations. The study used four watts Effective Radiated Power (ERP) for the unlicensed transmitter with an omni-directional antenna placed at every intersection of a 30-second grid (latitude and longitude) across major populated regions of the United States. The unlicensed transmitter height was set at a **modest height of 30 meters (HAAT)** and the number of available channels was determined for each 30-second grid (i.e. approximately a one square km area). The proposed protection ratios and service contours were as describe in Appendix B of the FCC docket)

Since the Free Press study only looked at the post-DTV-transition channel availability, the TechWare study mentioned above was revised to look at the post DTV transition spectrum availability. The methodology used was as follows:

- DTV stations with in-core channels were assumed to remain on that channel
- DTV stations with an out core DTV channel and an in core analog channel were assumed to continue as analog
- Analog low power stations with an in core channel were assumed to continue as analog
- All other analog stations were ignored
- The channel availability study was then performed in the same manner as the previous TechWare study with one exception. Based on the IEEE 802.22 Exparte filing with the FCC mentioned above, no adjacent channel operation of unlicensed devices was permitted inside the contour of an adjacent channel TV stations (full service or low power)
- After the completion of the above analyses the available channel count was adjusted to take into account full service stations with both their analog and digital channel out of core as well as any low power analog stations with out of core channels. This is justified by the fact that these stations will ultimately need to be provided an in core channel.

It is also noted that the channel availability determined in this analysis may need to be further reduced since some TV stations with low VHF assignments may need to be moved to a higher channels due to the adverse effects of manmade noise to DTV reception on those channels.

Figures 1, 2, 3, 4 & 5 present maps that show the potential availability of post-DTV-transition channels for unlicensed devices in the metropolitan areas of Trenton, NJ, San Francisco, CA, Reno, NV, Boston, MA & Phoenix, AZ respectively. The maps are color-coded to identify the number of TV channels available for unlicensed device operation in a given location.

P. O. Box 907 Warrenton, VA 20188
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Meintel, Sgrignoli, & Wallace

Figure 1

" White Space" Channel Availability for the City of Trenton, NJ & Vicinity

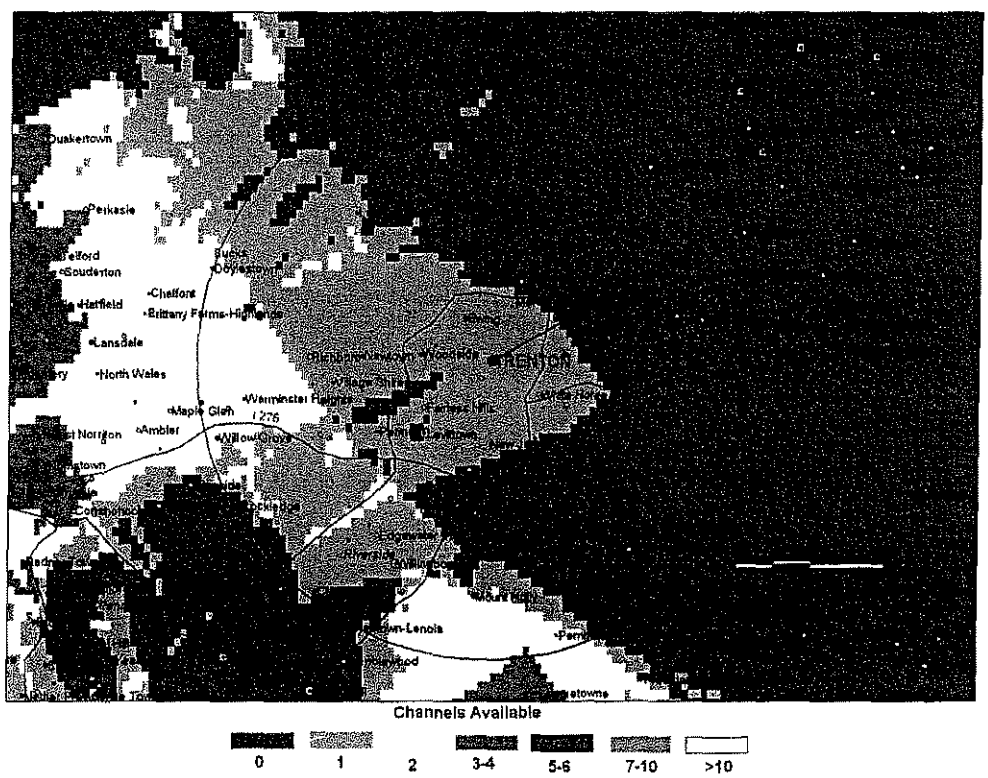

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Figure 2
" White Space" Channel Availability in City for the San Francisco, CA & Vicinity

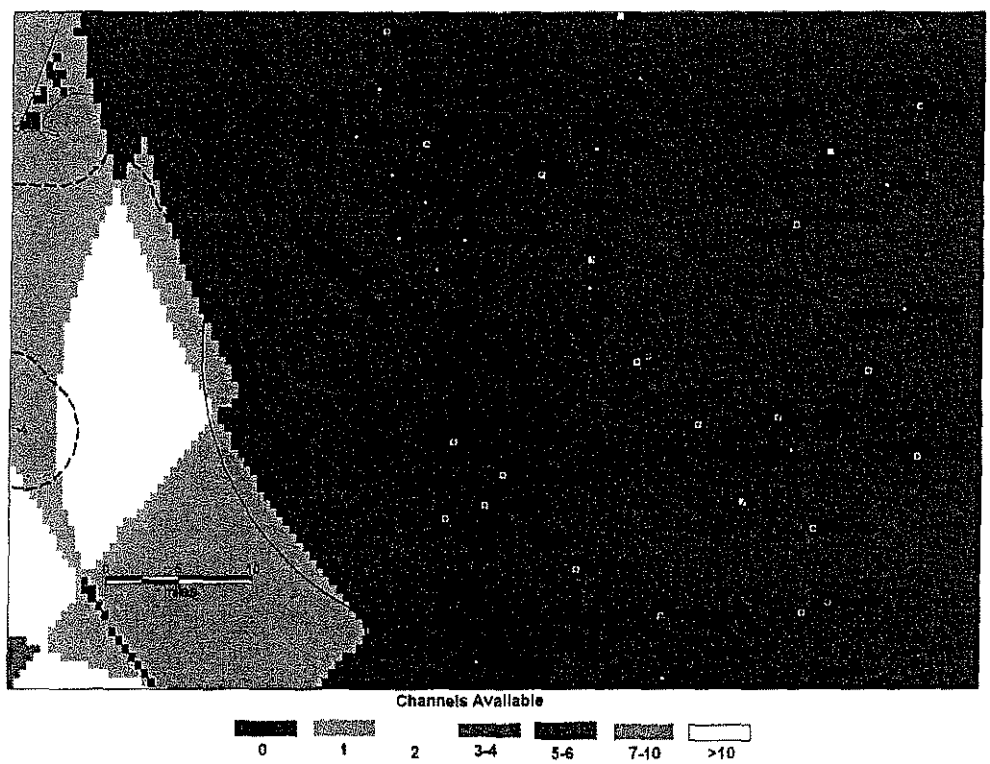

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Figure 3

" White Space" Channel Availability in City for the Reno, NV & Vicinity

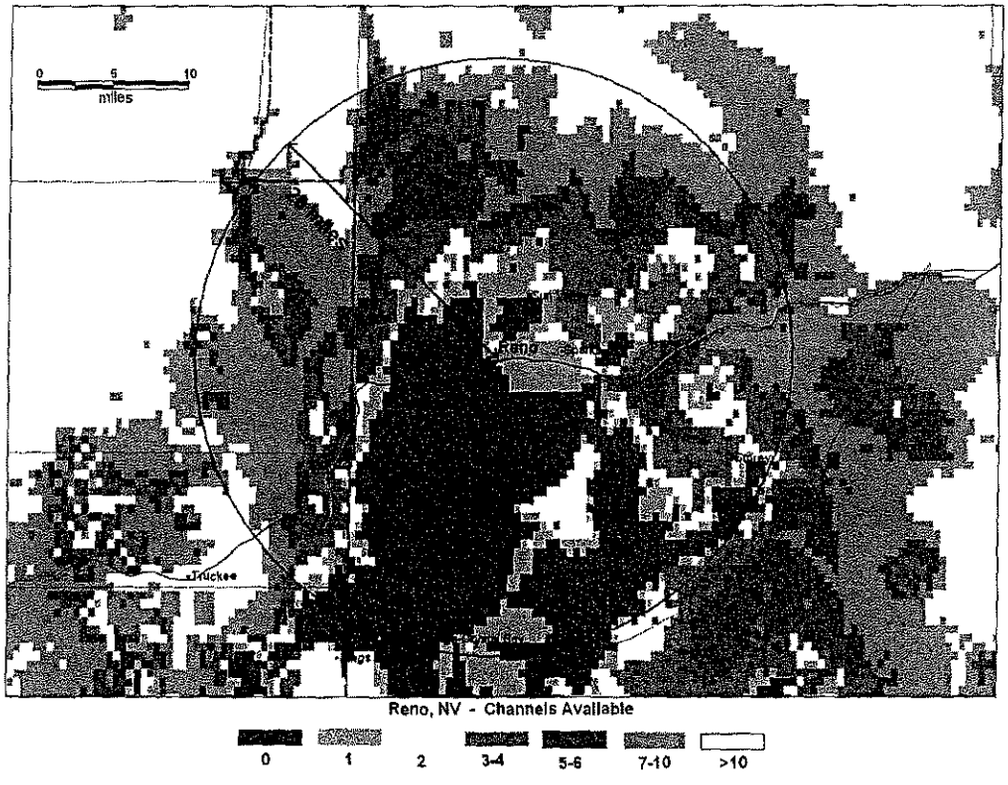

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Figure 4
" White Space" Channel Availability in City for the Boston MA& Vicinity

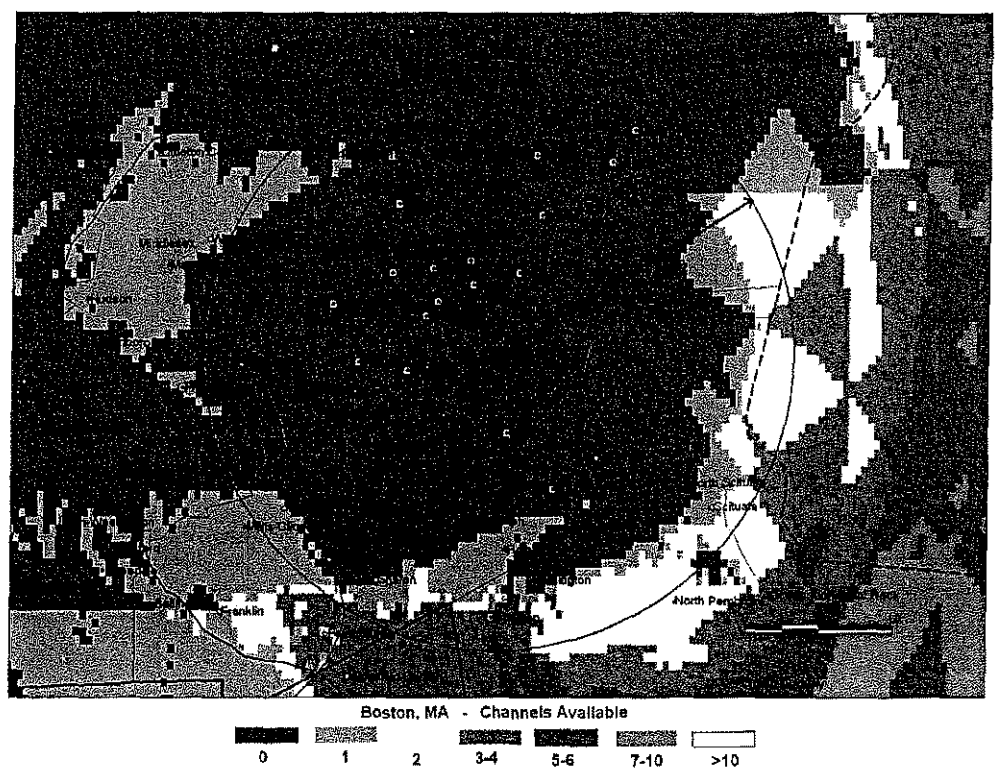

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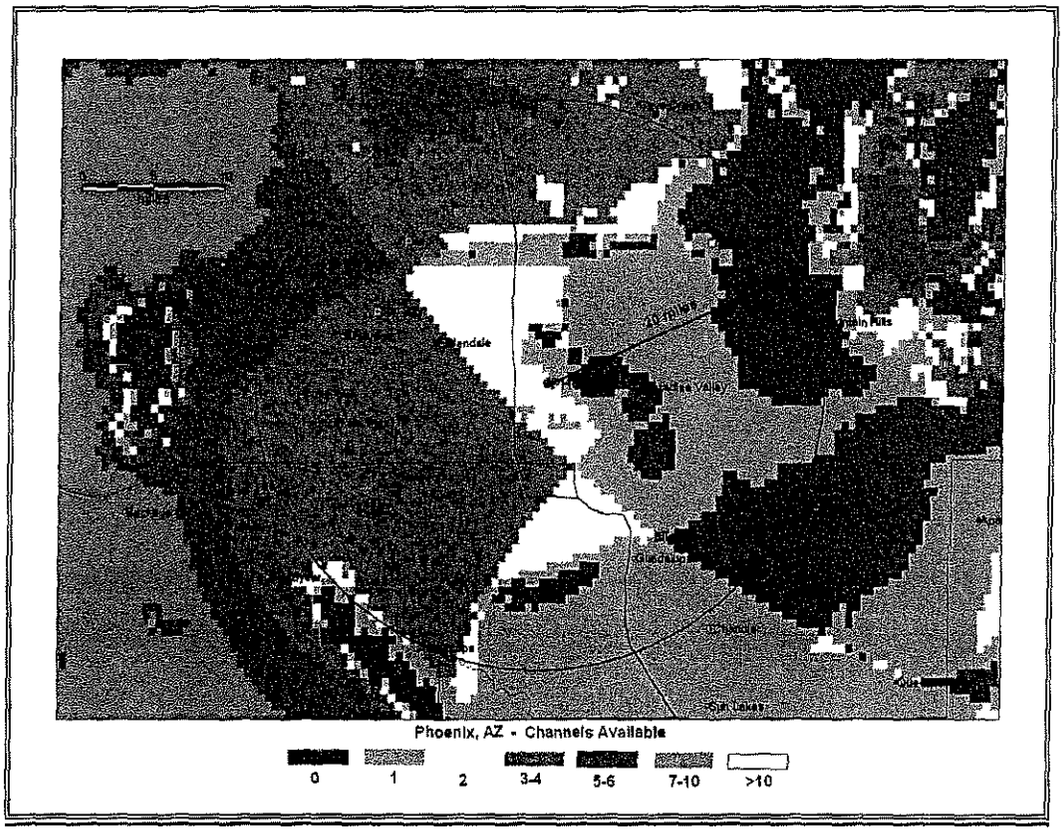
Figure 5
" White Space" Channel Availability in City for the Phoenix, AZ & Vicinity



As the channel availability maps show there is little or no spectrum available for unlicensed devices in and around many of the metropolitan areas. It is also noted that white space may exist at one point but not at adjacent points making it extremely difficult to design a useable system. Even in areas where white spaces do exist, the unlicensed devices may be subject to very strong fields from 2nd or 3rd adjacent TV channels, which are likely to overload the device and render it unusable.

Although the study does find white space in rural areas, there is another issue that has not been addressed in any of the studies. That is the impact on the receive channels of translator

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stations that typically are operating in the rural areas as well as rural cable television off-air receive sites.

Translator stations, especially in rural areas of the western United States, are commonly located on mountain peaks where they receive a primary station or that of another translator on one channel and retransmit it on another channel. The incoming signal does not provide service to most of the area and therefore would indicate as white space. However the presence of a nearby unlicensed device on that channel is likely to cause severe interference to the reception at the translator that from its high elevation can "see" both the desired station as well as the undesired unlicensed device. In these cases, the perceived white space may not really exist. It is also noted that in these rural areas, spectrum is also likely to be available in other bands not used for television.

With regard to cable television off-air receive sites, as in the translator case; these are often located well outside the Grade B contour of the desired station. Typically, these rural cable systems employ large receive antenna arrays mounted at heights of 300 feet or more to receive the desired TV signals. Based upon the methodology described here, these areas would likely be considered white-areas although a cable operator may, in fact, be receiving signals on these "vacant" channels. Disruption to this service from unlicensed devices on co-channel or adjacent channels may impact reception at the cable television receive site and thus impair reception to all the households in a given community.

Conclusion

Our analysis concludes that the Free Press study is *deeply flawed*. It *grossly overestimates* the amount of spectrum available in the 22 markets listed in the study. Moreover, the Study *lacks a defined methodology* and *ignores well- established interference protection criteria* proposed by IEEE and the Federal Communications Commission to protect the incumbents -- over-the-air television viewers and Private Land Mobile Service (PLMRS) users.

Moreover, our analysis also concludes that identifying white space requires complex engineering evaluation and analyses. Likewise fixed unlicensed transmitters will also require proper design and very careful installation taking into consideration nearby receive sites (such as translators and cable television operations) in addition to nearby transmitting stations. These requirements make it extremely difficult, if not impossible, for untrained unlicensed device operators to conduct these analyses and/or install these transmitters without proper guidance and/or oversight.

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P. O. Box 907 Warrenton, VA 20188
Phone 540-428-2308 Fax 540-428-2309

TRENTON, NJ

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7	PHILADELPHIA	PA	WWJT-LP	27.5	Low power TV/Translator	0
8	WILLOW GROVE, ETC.	PA	WELL-CA	23.7	Class A TV	0
9	BETHLEHEM	PA	WBPH-TV	41.7	Full Power Digital TV	0
10	Can not be used (adj. to WBPH Ch. 9 in Bethlehem)					0
11						1
12						1
13						1
14	WILMINGTON	DE	WTSD-CA	27.3	Class A TV	0
15	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
16	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
17	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
18	NEWTON	NJ	WMBC-TV	50.5	Full Power Digital TV	0
19	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
20	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
21	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	0
22	CAMDEN	NJ	WNJS	32.5	Full Power Digital TV	0
23	Can not be used (adj. to WNJS Ch.22in Camden & WNYE Ch, 24 in New York)					0
24	NEW YORK	NY	WNYE-TV	51.5	Full Power Digital TV	0
25	TRENTON	NJ	W25AW	2.4	Class A TV	0
26	PHILADELPHIA	PA	KYW-TV	27.6	Full Power Digital TV	0
27	BURLINGTON	NJ	WGTW-TV	27.3	Full Power Digital TV	0
28	NEW YORK	NY	WNBC	48.9	Full Power Digital TV	0
28	PHILADELPHIA	PA	WFPA-CA	27.5	Class A TV	0
29	WEST MILFORD	NJ	WFME-TV	44.8	Full Power Digital TV	0
30	NEW YORK	NY	WPXN-TV	48.9	Full Power Digital TV	0
31	WILMINGTON	DE	WPPX	27.3	Full Power Digital TV	0
32	PHILADELPHIA	PA	WPSG	27.3	Full Power Digital TV	0
33	CAMDEN	NJ	WXSI-LP	23.7	Low power TV/Translator	0
33	NEW YORK	NY	WPIX	48.9	Full Power Digital TV	0
33	PHILADELPHIA	PA	WXSI-LP	23.6	Low power TV/Translator	0
34	PHILADELPHIA	PA	WYBE	27.3	Full Power Digital TV	0
35	PHILADELPHIA	PA	WYBE	27.3	Full Power Digital TV	0
36	LINDEN	NJ	WNJU	51.5	Full Power Digital TV	0
37	Reserved for Radio Astronomy					0
38	SECACCUS	NJ	WWOR-TV	48.9	Full Power Digital TV	0
38	PHILADELPHIA	PA	WPHA-CA	27.5	Class A TV	0
39	EDISON	NJ	WDVB-CA	27.0	Class A TV	0
40	PATERSON	NJ	WXTV	51.5	Full Power Digital TV	0
41	NEWARK	NJ	WFUT-TV	51.9	Full Power Digital TV	0
41	SPRINGVILLE	NJ	WNAI-LP	27.3	Low power TV/Translator	0
42	PHILADELPHIA	PA	WLTX-TV	27.5	Full Power Digital TV	0
43	TRENTON	NJ	WNJT	5.2	Full Power Digital TV	0
44	ATLANTIC CITY	NJ	WMCN-TV	32.5	Full Power Digital TV	0
44	NEW YORK	NY	WNYW	51.5	Full Power Digital TV	0
45	NEW YORK	NY	WABC-TV	48.9	Full Power Digital TV	0
45	PHILADELPHIA	PA	WELL-Clas	27.5	Class A TV	0
46	ALLENTOWN	PA	WFMZ-TV	41.7	Full Power Digital TV	0
47	Can not be used(adj. to WFMZ Ch.46 in Allentown)					0
48	Can not be used (adj. to WWSI Ch. 49 in Philadelphia)					0
50	ATLANTIC CITY	NJ	WWSI	43.3	Full Power Digital TV	0
51	MONTCLAIR	NJ	WNJN	50.5	Full Power Digital TV	0
					Sub Total	5
	Out of Core Licensees (Ch.52- 69)					
	PHILADELPHIA	PA	WPHL-TV	27.3	Full Power Digital TV	-1
	WILMINGTON	DE	WHYY-TV	27.5	Full Power Digital TV	-1
	NEW YORK	NY	WCBS-TV	51.5	Full Power Digital TV	-1
	NEWARK	NJ	WNET	48.9	Full Power Digital TV	-1
	ALLENTOWN	PA	WLVT-TV	41.7	Full Power Digital TV	-1
	PHILADELPHIA	PA	WPVI-TV	27.6	Full Power Digital TV	-1
	VINELAND	NJ	WUVP-TV	27.3	Full Power Digital TV	-1
	PHILADELPHIA	PA	WCAVU	27.3	Full Power Digital TV	-1
					Total No. of Ch. available	0 (-3)

BOSTON, MA

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11						1
12	Can not be used (adj. to WPRI Ch 13 in Providence & WYCN ch. 13 in Nashua)					0
13	NASHUA	NH	WYCN-LP	33.0	Class A TV	0
13	PROVIDENCE	RI	WPRI-TV	33.5	Full Power Digital TV	0
[redacted]						0
[redacted]						0
[redacted]						0
17	BLOCK ISLAND	RI	WPXQ	67.0	Full Power Digital TV	0
18	LAWRENCE	MA	WMFP	8.6	Full Power Digital TV	0
19	BOSTON	MA	WGBH-TV	9.2	Full Power Digital TV	0
10	BOSTON	MA	WCVB-TV	9.2	Full Power Digital TV	0
21	PROVIDENCE	RI	WSBE-TV	34.3	Full Power Digital TV	0
22	NEW BEDFORD	MA	WLWC	38.8	Full Power Digital TV	0
23	MARLBOROUGH	MA	WUTF-TV	21.1	Full Power Digital TV	0
24	BOSTON	MA	WFXZ-CA	8.6	Class A TV	0
25	Can not be used (adj. to WFXZ Ch. 24 & WHDN Ch. 26 in Boston)					0
26	BOSTON	MA	WHDN-LP	0.1	Low Power TV/Translator	0
27	MARLBOROUGH	MA	WUTF-TV	21.1	Full Power Digital TV	0
28	MANCHESTER	NH	W28CM	30.8	Low Power TV/Translator	0
29	WORCESTER	MA	WUNI	31.8	Full Power Digital TV	0
30	BOSTON	MA	WBZ-TV	9.2	Full Power Digital TV	0
31	BOSTON	MA	WFXT	8.5	Full Power Digital TV	0
32	BOSTON	MA	WBPX	8.6	Full Power Digital TV	0
33	CONCORD	NH	WPXG	55.7	Full Power Digital TV	0
34	MERRIMACK	NH	WNEU	48.5	Full Power Digital TV	0
35	DERRY	NH	WZMY-TV	29.6	Full Power Digital TV	0
36	Can not be used (adj. to WZMY Ch. 35 in Derry)					0
37	Reserved for Radio Telescope					0
38	Can not be used (adj. to WSBK Ch.39 in Boston)					0
39	BOSTON	MA	WSBK-TV	9.2	Full Power Digital TV	0
40	BOSTON	MA	W40BO	8.6	Low Power TV/Translator	0
40	VINEYARD HAVEN	MA	WDPX	56.2	Full Power Digital TV	0
41	CAMBRIDGE	MA	WLVI-TV	8.5	Full Power Digital TV	0
42	BOSTON	MA	WHDH-TV	8.2	Full Power Digital TV	0
43	BOSTON	MA	WGBX-TV	9.2	Full Power Digital TV	0
44	Can not be used (adj. to WGBX Ch. 43 in Boston & WMEA Ch.45 in Biddeford)					0
45	BIDDEFORD	ME	WMEA-TV	70.7	Full Power Digital TV	0
46	Can not be used (adj. to WGBX Ch. 47 in Worcester & WMEA Ch.45 in Biddeford)					0
47	WORCESTER	MA	WYDN	8.6	Full Power Digital TV	0
48	Can not be used (adj. to WGBX Ch. 47 in Worcester & WLNE Ch.49 in New Bedford)					0
49	NEW BEDFORD	MA	WLNE-TV	34.3	Full Power Digital TV	0
50	PROVIDENCE	RI	WRIW-LP	41.6	Class A TV	0
51	PROVIDENCE		WJAR	34.3	Full Power Digital TV	0
					Sub Total	7
	Out of Core Licensees (Ch.52- 69)					
	NORWELL	MA	WWDP	22.9	Full Power Digital TV	-1
	PROVIDENCE	RI	WNAC-TV	34.1	Full Power Digital TV	-1
	DURHAM	NH	WENH-TV	54.3	Full Power Digital TV	-1
	BOSTON	MA	WCEA-LP	2.0	Low Power TV/Translator	-1
	MANCHESTER	NH	WMUR-TV	48.5	Full Power Digital TV	-1
	DOVER	NH	NEW	55.4	Full Power Digital TV	-1
	BOSTON	MA	WTMU-LP	1.3	Low Power TV/Translator	-1
					Total No. of Ch. available	0

MANCHESTER, NH

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11						1
12	Can not be used (adj. to WPRI Ch. 13 in providence & WYCN Ch. 13 in NASUA)					0
13	PROVIDENCE	RI	WPRI-TV	74.1	Full Power Digital TV	0
13	NASHUA	NH	WYCN-LP	17.9	Class A TV	0
14	[illegible]					0
15	[illegible]					0
16	[illegible]					0
17	Can not be used (adj. to WMFP Ch. 18 in Lawrence)					0
18	LAWRENCE	MA	WMFP	46.6	Full Power Digital TV	0
19	BOSTON	MA	WGBH-TV	46.3	Full Power Digital TV	0
20	BOSTON	MA	WCVB-TV	46.3	Full Power Digital TV	0
21	PROVIDENCE	RI	WSBE-TV	74.8	Full Power Digital TV	0
22	Can not be used (adj. to WSBE Ch. 21 in Providence & WUTF Ch. 23 in Marlborough)					0
23	MARLBOROUGH	MA	WUTF-TV	40.3	Full Power Digital TV	0
24	WINDSOR	VT	WVTA	55.9	Full Power Digital TV	0
25	HARTFORD	VT	WNNE	55.9	Full Power Digital TV	0
26	Can not be used (adj. to WNNE Ch. 25 in Hartford)					0
27	Can not be used (adj. to W28CM Ch. 28 in Manchester)					0
28	MANCHESTER	NH	W28CM	17.9	Low Power TV/Translator	0
29	WORCESTER	MA	WUNI	45.2	Full Power Digital TV	0
30	BOSTON	MA	WBZ-TV	46.3	Full Power Digital TV	0
31	BOSTON	MA	WFXT	46.9	Full Power Digital TV	0
32	BOSTON	MA	WBPX	46.6	Full Power Digital TV	0
33	NASHUA	NH	W33AK	15.3	Low Power TV/Translator	0
33	CONCORD	NH	WPXG	14.0	Full Power Digital TV	0
34	MERRIMACK	NH	WNEU	6.4	Full Power Digital TV	0
35	DERRY	NH	WZMY-TV	17.4	Full Power Digital TV	0
37	Reserved for Radio Telescope					0
38	Can not be used (adj. to W39AR Ch. 39 in Concord)					0
39	CONCORD	NH	W39AR	14.6	Low Power TV/Translator	0
39	BOSTON	MA	WSBK-TV	46.3	Full Power Digital TV	0
40	SPRINGFIELD	MA	WGGB-TV	76.2	Full Power Digital TV	0
41	Can not be used (adj. to WGGB Ch. 40 in Springfield)					0
42						1
43						1
44						0
45	BIDDEFORD	ME	WMEA-TV	41.7	Full Power Digital TV	0
46	POLAND SPRING	ME	WMTW-TV	65.0	Full Power Digital TV	0
47	WORCESTER	MA	WYDN	46.6	Full Power Digital TV	0
48	Can not be used (adj. To WEKW Ch. 49 in Keene& WYDN Ch. 47 in Worcester)					0
49	KEENE	NH	WEKW-TV	44.0	Full Power Digital TV	0
50	Can not be used (adj. To WEKW Ch. 49 in Keene)					0
51						1
					Sub Total	10
	Out of Core Licensees (Ch.52- 69)					
	NORWELL	MA	WWDP	67.7	Full Power Digital TV	-1
	PROVIDENCE	RI	WNAC-TV	74.4	Full Power Digital TV	-1
	DURHAM	NH	WENH-TV	16.8	Full Power Digital TV	-1
	SPRINGFIELD	MA	WGBY-TV	76.2	Full Power Digital TV	-1
	MANCHESTER	NH	WMUR-TV	6.5	Full Power Digital TV	-1
	DOVER	NH	NEW	28.6	Full Power Digital TV	-1
					Total No. of Ch. available	4

SAN FRANCISCO, CA

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11	Can not be used (adj. to KNTV Ch. 12 in San Jose)					0
12	SAN JOSE	CA	KNTV	6.0	Full Power Digital TV	0
13	Can not be used (adj. to KNTV Ch. 12 in San Jose)					0
14	Can not be used (adj. to KBSV Ch. 15 in Ceres)					0
15	CERES	CA	KBSV	64.3	Full Power Digital TV	0
[redacted]						0
[redacted]						0
[redacted]						0
19	SAN FRANCISCO	CA	KBWB	2.2	Full Power Digital TV	0
20	Can not be used (adj. to KBWB Ch.19 in San Francisco & KMAX Ch. 21 in Sacramento)					0
21	SACRAMENTO	CA	KMAX-TV	57.9	Full Power Digital TV	0
22	SANTA CLARA-SAN JOSE	CA	KAXT-CA	45.6	Class A TV	0
23	COTATI	CA	KRCB	38.6	Full Power Digital TV	0
24	SAN FRANCISCO	CA	KGO-TV	2.2	Full Power Digital TV	0
25	SANTA ROSA	CA	K25HI	49.9	Low PowerTV/Translator	0
25	STOCKTON	CA	KOVR	56.5	Full Power Digital TV	0
26	Can not be used (adj. to KOVR Ch.25 in Stockton & KTSF Ch. 27 in San Francisco)					0
27	SAN FRANCISCO	CA	KTSF	5.9	Full Power Digital TV	0
28	SAN FRANCISCO, ETC.	CA	KFTL-CA	5.8	Class A TV	0
29	SAN FRANCISCO	CA	KPIX-TV	2.1	Full Power Digital TV	0
30	SAN FRANCISCO	CA	KQED	2.2	Full Power Digital TV	0
31	Can not be used (adj.to KQED Ch. 30 in San francisco)					0
32	Can not be used (adj.to KMTP Ch. 32 in San francisco)					0
33	SAN FRANCISCO	CA	KMTP-TV	2.2	Full Power Digital TV	0
34	VALLEJO	CA	KFSF-TV	2.2	Full Power Digital TV	0
35	Can not be used (adj.to KFSF Ch. 33 in Vallejo)					0
36						1
37	Reserved for Radio Telescope					0
38	Can not be used (adj. to KCNS Ch. 39 in San Francisco)					0
39	SAN FRANCISCO	CA	KCNS	2.2	Full Power Digital TV	0
40	SAN FRANCISCO	CA	KMMC-LP	5.8	Low PowerTV/Translator	0
41	SAN JOSE	CA	KKPX	5.8	Full Power Digital TV	0
42	Can not be used (adj. to KKPX Ch. 41 in San Jose & KCSM Ch. 43 in San Mateo)					0
43	SAN MATEO	CA	KCSM-TV	2.2	Full Power Digital TV	0
44	Can not be used (Adj. to KCSM Ch. 43 in San Mateo & KBHK Ch. 45 in San Francisco)					0
45	SAN FRANCISCO	CA	KBHK-TV	2.2	Full Power Digital TV	0
46	STOCKTON	CA	KQCA	57.9	Full Power Digital TV	0
47	NOVATO	CA	KTLN-TV	26.3	Full Power Digital TV	0
48	SACRAMENTO	CA	KSPX	57.9	Full Power Digital TV	0
49	SAN JOSE	CA	KSTS	33.8	Full Power Digital TV	0
50	SAN JOSE	CA	KTEH	34.4	Full Power Digital TV	0
51	SAN FRANCISCO	CA	KDTV	33.8	Full Power Digital TV	0
					Sub Total	7
	Out of Core Licensees (Ch.52- 69)					
	SAN JOSE	CA	KICU-TV	34.4	Full Power Digital TV	-1
	SACRAMENTO	CA	KVIE	57.5	Full Power Digital TV	-1
	SANTA ROSA	CA	KFTY	59.8	Full Power Digital TV	-1
	SACRAMENTO	CA	KLTX	57.5	Full Power Digital TV	-1
	OAKLAND	CA	KTVU	2.2	Full Power Digital TV	-1
	SAN FRANCISCO	CA	KRON-TV	2.2	Full Power Digital TV	-1
	SACRAMENTO	CA	KXTV	56.5	Full Power Digital TV	-1
	STOCKTON	CA	KTFK-TV	26.9	Full Power Digital TV	-1
	CONCORD	CA	KTNC-TV	26.9	Full Power Digital TV	-1
					Total No. of Ch. available	0 (-2)

DALLAS-FORT WORTH, TX

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8	Cannot be used (adj. to WFAA Ch. In Dallas)					0
9	DALLAS	TX	WFAA-TV	16.5	Full Power Digital TV	0
10	Cannot be used (adj. to WFAA Ch. In Dallas)					0
11						1
12						1
13						1
14	DALLAS	TX	KERA-TV	16.0	Full Power Digital TV	0
15	Cannot be used (adj. to KERA Ch.14 in Dallas & land mobile Ch.16)					0
[redacted]						0
17	Cannot be used (adj. to KTXA Ch.14 in Dallas & land mobile Ch.16)					0
18	FORT WORTH	TX	KTXA	18.2	Full Power Digital TV	0
19	FORT WORTH	TX	KTVT	16.0	Full Power Digital TV	0
20	DALLAS	TX	KSEX-LP	15.3	Low Power TV/Translator	0
21	Cannot be used (adj. to KSEX ch. 20 in Dallas & KNAV Ch 22 in De Soto)					0
22	DE SOTO	TX	KNAV-LP	16.0	Low Power TV/Translator	0
23	Cannot be used (adj. to KNAV Ch. 22 in De Soto & KUVN Ch. 24 in Garland)					0
24	GARLAND	TX	KUVN-TV	16.0	Full Power Digital TV	0
25	CORSICANA	TX	K25FW	16.0	Low Power TV/Translator	0
25	GARLAND	TX	K57GF	9.8	Low Power TV/Translator	0
26	BRITTON	TX	KODF-LP	16.0	Low Power TV/Translator	0
27	Cannot be used (adj. to KODF Ch. 26 in Britton & KHPPK ch. 28 in De Soto)					0
28	DE SOTO	TX	KHPK-LP	16.0	Low Power TV/Translator	0
29	PLANO	TX	NEW	9.3	Auxillary DTV License	0
30	DECATUR	TX	KMPX	16.0	Full Power Digital TV	0
31	DE SOTO	TX	K31GL	16.0	Low Power TV/Translator	0
32	DALLAS	TX	KDAF	18.2	Digital Low Power TV	0
33	Cannot be used (adj. to KDAF Ch.32 & KJJM Ch. 34 in Dallas)					0
34	DALLAS & MESQUITE	TX	KJJM-LP	16.0	Low Power TV/Translator	0
35	DALLAS	TX	KDFW	16.5	Full Power Digital TV	0
36	DALLAS	TX	KDFI	18.2	Full Power Digital TV	0
37	Reserved for Radio Telescope					0
38	FORT WORTH	TX	KVFW-LP	16.0	Low Power TV/Translator	0
39	Cannot be used (adj. to KVFW Ch.38 & KXTX Ch. 40 in Dallas/Fort Worth)					0
40	DALLAS	TX	KXTX-TV	16.2	Full Power Digital TV	0
41	FORT WORTH	TX	KXAS-TV	16.2	Full Power Digital TV	0
42	ARLINGTON	TX	KPXD	16.0	Full Power Digital TV	0
43	DENTON	TX	KFTX	18.2	Full Power Digital TV	0
43	GREENVILLE	TX	KNOK-LP	38.6	Low Power TV/Translator	0
44	DALLAS	TX	KLEG-LP	0.6	Class A TV	0
45	DALLAS	TX	KFTX	18.2	Full Power Digital TV	0
46	GREENVILLE	TX	KTAQ	18.2	Full Power Digital TV	0
47	FORT WORTH	TX	KUVN-CA	30.0	Class A TV	0
48	IRVING	TX	KSTR-TV	18.2	Full Power Digital TV	0
49	Cannot be used (adj. to KSTR Ch 48 in Irving& KATA Ch. 40 in Mesquite)					0
50	MESQUITE	TX	KATA-CA	16.0	Class A TV	0
51	FORT WORTH	TX	KFWD	16.0	Full Power Digital TV	0
					Sub Total	6
	Out of Core Licensees (Ch.52- 69)					
	GREENVILLE	TX	KNOK-LP	23.4	Low Power TV/Translator	-1
	LAKE DALLAS	TX	KL TX	18.2	Full Power Digital TV	-1
	DALLAS	TX	KSEX-LP	16.0	Low Power TV/Translator	-1
	SHERMAN	TX	NEW	57.1	New Full Power Rulemaking	-1
	GAINESVILLE	TX	KBFW-LP	39.0	Low Power TV/Translator	-1
					Total No. of Ch. available	1

SEATTLE, WA

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	ISSAQUAH, ETC.	WA	K03FA	18.5	Low power TV/Translator	0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9	Can not be used (adj. to K10LA ch.10 in Issaquah)					0
10	ISSAQUAH, ETC.	WA	K10LA	18.5	Low power TV/Translator	0
11	Can not be used (adj. to K10LA ch.10 in Issaquah)					0
12						1
13						1
14	TACOMA	WA	KTBW-TV	20.9	Full Power Digital TV	0
15	Can not be used (adj. to KTBW Ch.14 in Tacoma)					0
16						1
17	Can not be used (adj. to KCPQ Ch. 17 in Tacoma)					0
18	TACOMA	WA	KCPQ	21.4	Full Power Digital TV	0
19	BELLINGHAM	WA	KBCB	74.0	Full Power Digital TV	0
20	Can not be used (adj. to KBCB Ch. 19 in Bellingham)					0
21						1
22						1
23						1
24	Can not be used (adj. to KTWB Ch. 25 in Seattle)					0
25	SEATTLE	WA	KTWB-TV	1.2	Full Power Digital TV	0
26	Can not be used (adj. to KTWB Ch. 25 in Seattle & KBTC Ch.27 in Tacoma)					0
27	TACOMA	WA	KBTC-TV	23.0	Full Power Digital TV	0
28	Can not be used (adj. to KBTC Ch.27 in Tacoma & KBTC Ch.29 in Everett)					0
29	EVERETT	WA	K29ED	26.1	Low power TV/Translator	0
30	Can not be used (adj. to KBTC Ch.29 & KONG Ch. 31 in Everett)					0
31	EVERETT	WA	KONG-TV	1.9	Full Power Digital TV	0
32	BELLEVUE	WA	KWPX	17.4	Full Power Digital TV	0
33	Can not be used (adj. to KWPX Ch. 32 in Bellevue)					0
34	Can not be used (adj. to KWPX Ch. 35 in Bellingham)					0
35	BELLINGHAM	WA	KVOS-TV	73.8	Full Power Digital TV	0
36	TACOMA	WA	KSTW	1.2	Full Power Digital TV	0
37	Reserved for Radio Telescope					0
38	SEATTLE	WA	KOMO-TV	2.0	Full Power Digital TV	0
39	SEATTLE	WA	KIRO-TV	2.1	Full Power Digital TV	0
40	Can not be used (adj. to KIRO Ch.39 & KCTS Ch. 41 in Seattle)					0
41	SEATTLE	WA	KCTS-TV	1.2	Full Power Digital TV	0
42	TACOMA	WA	KWDK	17.4	Full Power Digital TV	0
43						0
44	SEATTLE	WA	KHCV	17.4	Full Power Digital TV	0
45	Can not be used (adj. to KHCV Ch.44 in Seattle)					0
46						1
47	Can not be used (adj. to KING Ch.48 in Seattle)					0
48	SEATTLE	WA	KING-TV	1.9	Full Power Digital TV	0
49	Can not be used (adj. to KING Ch.48 in Seattle & KWOG Ch. 50 in Bellevue)					0
50	BELLEVUE	WA	KWOG	17.5	Full Power Digital TV	0
51	Can not be used (adj. to KWOG Ch. 50 in Bellevue)					0
					Sub Total	11
	Out of Core Licensees (Ch.52- 69)					
	SEATTLE	WA	NEW	17.4	Pending RM for Full power	-1
	BREMERTON	WA	K54AO	17.6	Low power TV/Translator	-1
	PUYALLUP	WA	K54GS	28.6	Low power TV/Translator	-1
	SEATTLE	WA	KUSE-LP	0.5	Low power TV/Translator	-1
	POINT PULLEY, ETC.	WA	K67GJ	12.6	Low power TV/Translator	-1
	SEATTLE	WA	K68DL	1.2	Low power TV/Translator	-1
					Total No. of Ch. available	5

PHOENIX, AZ

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11						1
12						1
13						1
14						1
15						1
16	Can not be used (adj. to KPHO CH. 17 in Phoenix)					0
17	PHOENIX	AZ	KPHO-TV	7.6	Full Power Digital TV	0
18	PRESCOTT	AZ	K28FF	27.8	Low Power TV/Translator	0
19	PHOENIX	AZ	KPHE-LP	23.9	Low Power TV/Translator	0
20	PHOENIX	AZ	KPAZ-TV	7.5	Full Power Digital TV	0
21	Can not be used (adj. to KPAZ CH. 20 & KTVP Ch. 22 in Phoenix)					0
22	PHOENIX	AZ	KTVP-LP	7.6	Low Power TV/Translator	0
23	SCOTTSDALE	AZ	K23BY	13.9	Low Power TV/Translator	0
24	PHOENIX	AZ	KTVK	7.6	Full Power Digital TV	0
25	PHOENIX	AZ	K25DM	9.6	Low Power TV/Translator	0
26	PHOENIX	AZ	KUTP	7.6	Full Power Digital TV	0
27	PHOENIX	AZ	KAZT-CA	7.6	Class A TV	0
28	PHOENIX	AZ	KCOS-LP	23.9	Class A TV	0
28	PRESCOTT	AZ	K28FF	27.8	Low Power TV/Translator	0
29	PHOENIX	AZ	KAET	7.6	Full Power Digital TV	0
30	Can not be used (adj. to KAET Ch. 29 & KSAZ Ch.31 in Phoenix)					0
31	PHOENIX	AZ	KSAZ-TV	7.6	Full Power Digital TV	0
32	Can not be used (adj. toKZAS Ch.31 in Phoenix)					0
33	Can not be used (adj. to KTVW Ch. 34 in Phoenix)					0
34	PHOENIX	AZ	KTVW-TV	7.6	Full Power Digital TV	0
35	PHOENIX	AZ	KFPH-CA	7.6	Class A TV	0
36	MESA	AZ	KPNX	7.6	Full Power Digital TV	0
37	Reserved for Radio Telescope					0
38	PHOENIX	AZ	K53GF	7.6	Low Power TV/Translator	0
39	PHOENIX	AZ	KDTP	7.6	Full Power Digital TV	0
40	Can not be used (adj. to KDTP Ch. 39 & KPDF Ch. 41 in Phoenix)					0
41	PHOENIX	AZ	KPDF-CA	7.6	Class A TV	0
42	PHOENIX	AZ	K42FD	23.9	Low Power TV/Translator	0
43	CASA GRANDE	AZ	K43CO	36.7	Low Power TV/Translator	0
43	PHOENIX	AZ	KQBN-LP	7.6	Low Power TV/Translator	0
44	PHOENIX	AZ	KPHE-LP	7.6	Low Power TV/Translator	0
45	Can not be used (adj to KPHE Ch. 44 in Phoenix)					0
46						1
47	Can not be used (adj. to KDRX Ch. 48 in Phoenix)					0
48	PHOENIX	AZ	KDRX-CA	7.5	Class A TV	0
49	PHOENIX	AZ	KASW	7.6	Full Power Digital TV	0
50	Can not be used (adj. to. KASW Ch. 49 in Phoenix)					0
51						1
					Sub Total	13
	Out of Core Licensees (Ch.52- 69)					
	TOLLESON	AZ	KPPX	7.5	Full Power Digital TV	-1
	PHOENIX	AZ	K55EH	9.8	Low Power TV/Translator	-1
	PHOENIX	AZ	KNXV-TV	7.6	Full Power Digital TV	-1
	MESA	AZ	K57HX	24.0	Low Power TV/Translator	-1
	PHOENIX	AZ	KPHZ-LP	7.6	Low Power TV/Translator	-1
	PHOENIX	AZ	KTVP-LP	7.6	Low Power TV/Translator	-1
					Total No. of Ch. available	7

PORTLAND, OR

Ch.	City	State	Class A TV	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	SALEM	OR	KPXG	3.3	Full Power Digital TV	0
5	PORTLAND	OR	KWBP-LP	2.7	Low Power TV/Translator	0
6	can not be used (adj. To KWBP Ch. 5 in Portland)					0
7						1
8						1
9						1
10						1
11						1
12						1
13						1
14						1
15	Can not be used (adj. to KORS Ch. 16 in Salem)					0
16	SALEM	OR	KORS-CA	3.3	Class A TV	0
17	Can not be used (adj. to K16EL Ch. 18 in Tigard & KORS Ch. 16 in Salem)					0
18	NEWBERG/TIGARD	OR	K18EL	18.2	Low Power TV/Translator	0
19	CENTRALIA	WA	KCKA	70.1	Full Power Digital TV	0
20	CAMAS	WA	KOXI-CA	3.3	Class A TV	0
21	Can not be used (adj. to KOXI Ch. 20 in Camas)					0
22						1
23						1
24						1
25	Can not be used (adj. to K26GJ Ch. 26 in Portland)					0
26	PORTLAND	OR	K26GJ	7.3	Low Power TV/Translator	0
27	PORTLAND	OR	KOPB-TV	3.3	Full Power Digital TV	0
28	Can not be used (adj. to KOPB Ch. 27 in Portland)					0
29	Can not be used (adj. to KPTV Ch. 30 in Porland)					0
30	PORTLAND	OR	KPTV	3.3	Full Power Digital TV	0
31	Can not be used (adj. to KPTV Ch. 30 in Porland)					0
32	Can not be used (adj.to KWBP Ch. 33 in Salem)					0
33	SALEM	OR	KWBP	2.7	Full Power Digital TV	0
34	Can not be used (adj. to KWBP Ch.33 in Salem & KORK Ch. 35 in Portland)					0
35	PORTLAND	OR	KORK-CA	3.3	Class A TV	0
36	Can not be used (adj. To KORK Ch. 35 in Portland)					0
37	Reserved for radio telescope					0
38	PORTLAND	OR	KKEI-CA	3.3	Class A TV	0
39	CORVALLIS	OR	KOAC-TV	64.4	Full Power Digital TV	0
40	PORTLAND	OR	KOIN	2.7	Full Power Digital TV	0
41	Can not be used (adj. to KOIN Ch.40 in Portland)					0
42	Can not be used (adj. to KATU Ch. 43 in Portalnd)					0
43	PORTLAND	OR	KATU	2.7	Full Power Digital TV	0
44	Can not be used (adj. to KATU Ch. 43 & KNMT Ch.45 in Portland)					0
45	PORTLAND	OR	KNMT	2.7	Full Power Digital TV	0
46	PORTLAND	OR	KGW	3.3	Full Power Digital TV	0
47	PORTLAND	OR	KPOU-LP	3.3	Low Power TV/Translator	0
48	VANCOUVER	WA	KPDX	3.5	Full Power Digital TV	0
49	Can not be used (adj. to KPDX Ch.48 in Vancouver)					0
50	Can not be used (adj. to KOXO Ch. 51 in Newberg)					0
51	NEWBERG	OR	KOXO-CA	3.3	Class A TV	0
					SubTotal	11
	Out of Core Licensees (Ch.52- 69)					
	PORTLAND	OR	KPXG-LP	3.3	Low Power TV/Translator	-1
					Total No. of Ch. available	10

LAS VEGAS, NV

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	LAS VEGAS	NV	KVBC	13.0	Full Power Digital TV	0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7	LAS VEGAS	NV	KLAS-TV	15.9	Full Power Digital TV	0
8	Can not be used (adj. to KLAS Ch. 7 in Las Vegas & KWU Ch.9 in Henderson)					0
9	HENDERSON	NV	KVVU-TV	13.0	Full Power Digital TV	0
10	Can not be used (adj. to KWU Ch.9 in Henderson & KLVX in Ch. 11 in Las Vegas)					0
11	LAS VEGAS	NV	KLVX	13.0	Full Power Digital TV	0
12	LAS VEGAS	NV	KTNV	15.9	Digital Low Power TV	0
13	Can not be used (adj. to KTNX Ch. 12 in Las Vegas)					0
14						1
15	Can not be used (adj. to KINC Ch. 16 in Las Vegas)					0
16	LAS VEGAS	NV	KINC	15.9	Full Power Digital TV	0
17	LAS VEGAS	NV	KEEN-LP	11.0	Class A TV	0
18	Can not be used (adj. to KEEN Ch. 16 in Las Vegas & KHDF Ch. 19 in Las Vegas)					0
19	LAS VEGAS	NV	KHDF-CA	13.0	Class A TV	0
20	Can not be used (adj. to KHDF Ch. 19 in Las Vegas)					0
21	Can not be used (adj. to KVWB Ch. 22 in Las Vegas)					0
22	LAS VEGAS	NV	KVWB	13.0	Full Power Digital TV	0
23	LAS VEGAS	NV	KLVD-LP	12.9	Low Power TV/Translator	0
24	Can not be used (adj. to KLVD Ch. 23 & KTUD Ch. 25 in Las Vegas)					0
25	LAS VEGAS	NV	KTUD-CA	15.9	Class A TV	0
26	Can not be used (adj. To KTUD Ch.25 & KELV Ch. 27 in Las Vegas)					0
27	LAS VEGAS	NV	KELV-LP	13.0	Low Power TV/Translator	0
28	LAS VEGAS	NV	KVPX-LP	13.0	Low Power TV/Translator	0
29	LAS VEGAS	NV	KFBT	13.0	Full Power Digital TV	0
30	LAS VEGAS	NV	KEGS-LP	15.9	Low Power TV/Translator	0
31	LAS VEGAS	NV	KNBX-CA	15.9	Class A TV	0
32	Can not be used (adj. to KNBX Ch. 31 in Las Vegas)					0
33						1
34	Can not be used (adj. to KVTE Ch. 35 in Las Vegas)					0
35	LAS VEGAS	NV	KVTE-LP	15.9	Low Power TV/Translator	0
36	Can not be used (adj. to KVTE Ch. 35 in Las Vegas)					0
37	Reserved for Radio Telescope					0
38						1
39	Can not be used (adj. to KBLR Ch. 39 in Las Vegas)					0
40	PARADISE	NV	KBLR	12.9	Full Power Digital TV	0
41	LAS VEGAS	NV	K41IO	13.0	Low Power TV/Translator	0
42	Can not be used (adj. to K41IO Ch. 41 & K43FO Ch. 43 in Las Vegas)					0
43	LAS VEGAS	NV	K43FO	12.9	Class A TV	0
44	Can not be used (adj. to Ch. 43 in Las Vegas & RM Ch. 43 in N. Las Vegas)					0
45	NORTH LAS VEGAS	NV	NEW	2.2	New Full Power RM	0
46	HENDERSON	NV	K46GX	18.8	Low Power TV/Translator	0
47	LAS VEGAS	NV	KGNG-LP	15.9	Low Power TV/Translator	0
48	Can not be used (adj. to KGNG Ch. 47 in Las Vegas)					0
49	Can not be used (adj. to KLSV CH.50 in Las Vegas)					0
50	LAS VEGAS	NV	KLSV-LP	13.0	Low Power TV/Translator	0
51	PAHRUMP	NV	K51AC	23.7	Low Power TV/Translator	0
					Sub Total	5
	Out of Core Licensees (Ch.52- 69)					
	MERCURY, NEVADA TEST	NV	K52AC	25.1	Low Power TV/Translator	-1
	PAHRUMP	NV	K53AE	23.7	Low Power TV/Translator	-1
	MERCURY, ETC.	NV	K54BO	25.1	Low Power TV/Translator	-1
					Total No. of Ch. available	2

Little Rock, AR

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5	LITTLE ROCK	AR	KETS	21.4	Full Power Digital TV	0
6	Can not be used (adj. to KETS Ch. 5 in Little Rock)					1
7						1
8						1
9						1
10						1
11	Can not be used (adj. to KTHV Ch. 12 in Little Rock)					0
12	LITTLE ROCK	AR	KTHV	12.5	Full Power Digital TV	0
13	MOUNTAIN VIEW	AR	KEMV	73.7	Full Power Digital TV	0
13	ARKADELPHIA	AR	KETG	74.6	Full Power Digital TV	0
13	LITTLE ROCK, ETC.	AR	KZJG-LP	4.0	Low Power TV/Translator	0
14	LITTLE ROCK	AR	KHUG-LP	6.2	Low Power TV/Translator	0
14	HOT SPRINGS	AR	KVTH	50.2	Full Power Digital TV	0
15	Can not be used (adj. to KHUG Ch.14 in little Rock & KTHV Ch. 14 in Hot Springs)					0
16						1
17						1
18						1
19	Can not be used (adj. to KKYK Ch.20 in Little Rock)					0
20	LITTLE ROCK	AR	KKYK-CA	12.2	Class A TV	0
21	Can not be used (adj. to KKYK Ch.20 & KATV Ch.22 in Little Rock)					0
22	LITTLE ROCK	AR	KATV	19.5	Full Power Digital TV	0
23	Can not be used (adj. to KATV Ch.22 in Little Rock & KVTN Ch. 24 in Pine Bluff)					0
24	PINE BLUFF	AR	KVTN	20.3	Full Power Digital TV	0
25	Can not be used (adj. to KVTN Ch. 24 in Pine Bluff)					0
26						1
27	Can not be used (adj. to KJLR Ch. 28 in Little Rock)					0
28	LITTLE ROCK, ETC.	AR	KJLR-LP	0.8	Class A TV	0
29	Can not be used (adj. to KJLR Ch. 28 & KLRT Ch. 30 in Little Rock)					0
30	LITTLE ROCK	AR	KLRT-TV	12.0	Full Power Digital TV	0
31	Can not be used (adj. to KLRT Ch. 30 & KARK Ch. 32 in Little Rock)					0
32	LITTLE ROCK	AR	KARK-TV	12.5	Full Power Digital TV	0
33	Can not be used (adj. to K34FH Ch. 34 & KARK Ch. 32 in Little Rock)					0
34	LITTLE ROCK	AR	K34FH	12.0	Low Power TV/Translator	0
35	Can not be used (adj. to K34FH Ch. 34 in Little Rock)					0
36						1
37	Reserved For Radio Telescope					0
38						1
39						1
40						1
41						1
42						1
43	Can not be used (adj. to KWBF Ch. 44 in Little Rock)					0
44	LITTLE ROCK	AR	KWBF	12.2	Full Power Digital TV	0
45	PINE BLUFF	AR	KWBK-LP	19.4	Low Power TV/Translator	0
46	LITTLE ROCK	AR	KLRA-LP	4.2	Low Power TV/Translator	0
47	SHERIDAN	AR	KWBF-LP	22.1	Low Power TV/Translator	0
48	LITTLE ROCK	AR	K27FF	12.5	Low Power TV/Translator	0
49	Can not be used (adj. to K27FF Ch. 48 & KHTE Ch. 50 in Little Rock)					0
50	LITTLE ROCK	AR	KHTE-LP	12.2	Low Power TV/Translator	0
51	Can not be used (adj. to K27FF Ch. 48 & KHTE Ch. 50 in Little Rock)					0
					Sub Total	15
	Out of Core Licensees (Ch.52- 69)					
	LITTLE ROCK	AR	K55GE	0.8	Low Power TV/Translator	-1
					Total No. of Ch. available	14

RICHMOND, VA

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11						1
12						1
13						1
14						0
15	Can not be used (adj. to WHRO Ch. 16 in Hampton)					0
16	HAMPTON-NORFOLK	VA	WHRO-TV	70.1	Full Power Digital TV	0
17	RICHMOND	VA	WXOB-LP	4.9	Class A TV	0
18	Can not be used (adj. to WXOB Ch. 17 in Richmond)					0
19						1
20						1
21	Can not be used (adj. to WRIC Ch.22 in St. Petersburg)					0
22	PETERSBURG	VA	WRIC-TV	7.8	Full Power Digital TV	0
23	Can not be used (adj. to WRIC Ch.22 in St. Petersburg)					0
24	Can not be used (adj. to WTVR Ch. 25 in Richmomd)					0
25	RICHMOND	VA	WTVR-TV	7.8	Full Power Digital TV	0
26	RICHMOND	VA	WRLH-TV	7.8	Full Power Digital TV	0
27	Can not be used (adj. to WRLH Ch. 26 in Richmond)					0
28	Can not be used (adj. to WVBT Ch. 29 in Virginia Beach)					0
29	VIRGINIA BEACH	VA	WVBT	69.3	Full Power Digital TV	0
30	GOLDVEIN	VA	WNVT	70.7	Full Power Digital TV	0
31	PORTSMOUTH	VA	WAVY-TV	69.3	Full Power Digital TV	0
32	CHARLOTTESVILLE	VA	WVIR-TV	60.1	Full Power Digital TV	0
33	Can not be used (adj. to WVIR Ch. 32 in Charlotteville)					0
34						1
35						1
36						1
37	Reserved for Radio Telescope					0
38	NORFOLK	VA	WTVZ-TV	70.1	Full Power Digital TV	0
39	RICHMOND	VA	NEW	12.8	New NTSC RuleMaking	0
40	NORFOLK	VA	WTKR	70.1	Full Power Digital TV	0
41	HAMPTON	VA	WVEC-TV	71.1	Full Power Digital TV	0
42	RICHMOND	VA	WCVE-TV	7.8	Full Power Digital TV	0
43	Can not be used (Adj. to WCVE Ch.42 & WCVW Ch. 44 in Ricmond)					0
44	RICHMOND	VA	WCVW	7.8	Full Power Digital TV	0
45	KEYSVILLE	VA	WKYV-LP	0.7	Low power TV/Translator	0
46	CHARLOTTESVILLE	VA	WHTJ	60.2	Full Power Digital TV	0
46	NORFOLK	VA	WPXV	70.1	Full Power Digital TV	0
47	ASHLAND	VA	WUPV	16.4	Full Power Digital TV	0
48	RICHMOND	VA	WRID-LP	7.8	Low power TV/Translator	0
49	Can not be used (adj.to WRID Ch. 48 in Richmond & WGNT ch.59 in Portsmouth)					0
50	PORTSMOUTH	VA	WGNT	71.5	Full Power Digital TV	0
51	HAMPTON	VA	W51DO	61.6	Low power TV/Translator	0
					Sub Total	14
	Out of Core Licensees (Ch.52- 69)					
	RICHMOND	VA	WWBT	3.8	Full Power Digital TV	-1
					Total No. of Ch. available	13

Charleston, WV

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7	Can not be used (adj. to WVNS Ch. 8 in Lewisburg)					0
8	LEWISBURG	WV	WVNS-TV	64.2	Full Power Digital TV	0
9	Can not be used (adj. to WVNS Ch. 8 in Lewisburg)					0
10						1
11						1
12						1
13						1
14						1
15	Can not be used (adj. to W16CE Ch.16 in Charleston)					0
16	CHARLESTON	WV	W16CE	2.2	Low Power TV/Translator	0
17	Can not be used (adj. to W16CE Ch.16 in Charleston)					0
18	Can not be used (adj. to WVAH Ch.19 in Charleston)					0
19	CHARLESTON	WV	WVAH-TV	15.2	Full Power Digital TV	0
20	Can not be used (adj. to WVAH Ch.19 & WOWB Ch. 21in Charleston)					0
21	CHARLESTON	WV	WOWB-LP	2.2	Low Power TV/Translator	0
22	Can not be used (adj. to WSAZ Ch.23 in Huntington & WOWB Ch. 21 in Charleston)					0
23	HUNTINGTON	WV	WSAZ-TV	33.6	Full Power Digital TV	0
24	Can not be used (adj. to WSAZ Ch.23 in Huntington)					0
25	Can not be used (adj. to WKAS Ch.26 in Ashland)					0
26	ASHLAND	KY	WKAS	54.0	Full Power Digital TV	0
27	ATHENS	OH	WOUB-TV	72.2	Full Power Digital TV	0
28	Can not be used (adj. to WOUB Ch.27in Athens)					0
29						1
30	Can not be used (adj. to W31CA in Charleston)					0
31	CHARLESTON	WV	W31CA	4.2	Low Power TV/Translator	0
32	Can not be used (adj. to W31CA in Charleston)					0
33	Can not be used (adj. to WPBY Ch.34 in Huntington)					0
34	HUNTINGTON	WV	WPBY-TV	32.3	Full Power Digital TV	0
35	Can not be used (adj. to WPBY Ch.34 in Huntington)					0
36						1
37	Reserved for Radio Telescope					0
38	Can not be used (adj. to WLPX Ch.39 in Charleston)					0
39	CHARLESTON	WV	WLPX-TV	11.4	Full Power Digital TV	0
40	Can not be used (adj. to WLPX Ch.39 & WCHS Ch. 41 in Charleston)					0
41	CHARLESTON	WV	WCHS-TV	15.2	Full Power Digital TV	0
42	Can not be used (adj. to WCHS Ch. 41 in Charleston)					0
43	Can not be used (adj. to WTSF Ch.44 in Ashland)					0
44	ASHLAND	KY	WTSF	41.9	Full Power Digital TV	0
45	Can not be used (adj. to WTSF Ch.44 in Ashland)					0
46	Can not be used (adj. to WOWK Ch.47 in Huntington)					0
47	HUNTINGTON	WV	WOWK-TV	33.0	Full Power Digital TV	0
48	Can not be used (adj. to WOWK Ch.47 in Huntington & WTAP Ch.49 in Parkersburg)					0
49	PARKERSBURG	WV	WTAP-TV	69.2	Full Power Digital TV	0
50	OAK HILL	WV	WOAY-TV	37.7	Full Power Digital TV	0
51	ASHLAND	KY	NEW	33.0	Rule Making	0
					Sub total	9
	Out of Core Licensees (Ch.52- 69)					
	GRANDVIEW	WV	WSWP-TV	47.0	Full Power Digital TV	-1
					Total No. of Ch. available	8

Portland, ME

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11						1
12						1
13						1
14	Can not be used (adj. to WLLP Ch. 15 in Portland)					0
15	PORTLAND	ME	WLLB-LP	5.8	Low power TV/Translator	0
16	Can not be used (adj. to WLLP Ch. 15 in Portland& WCBB Ch.17 in Augusta)					0
17	AUGUSTA	ME	WCBB	36.2	Full Power Digital TV	0
18	Can not be used (adj. to WCBB Ch.17 in Augusta)					0
19						1
20						1
21						1
22						1
23						1
24						1
25						1
26						1
27	Can not be used (adj. to WPME Ch. 28 in Lewiston)					0
28	LEWISTON	ME	WPME	13.6	Full Power Digital TV	0
29	BRUNSWICK	ME	W29CA	26.8	Low power TV/Translator	0
30	Can not be used (adj. to W29CA Ch. 29 in Brunswick)					0
31	Can not be used (adj. to W32CA Ch. 32 in Portland)					0
32	PORTLAND	ME	W32CA	6.9	Low power TV/Translator	0
33	CONCORD	NH	WPXG	62.7	Full Power Digital TV	0
34	Can not be used (adj. to WPGX Ch. 33 in Concord)					0
35						1
36						1
37						0
38	PORTLAND	ME	WGME-TV	21.6	Full Power Digital TV	0
39	Can not be used (adj. to WGME Ch. 38 in Portland)					0
40						1
41						1
42	Can not be used (adj. to WLLP Ch. 15 in Portland)					0
43	PORTLAND	ME	WPXT	13.6	Full Power Digital TV	0
44	PORTLAND	ME	WCSH	26.5	Full Power Digital TV	0
45	BIDDEFORD	ME	WMEA-TV	32.3	Full Power Digital TV	0
46	POLAND SPRING	ME	WMTW-TV	28.3	Full Power Digital TV	0
47	Can not be used (adj. to W66CL Ch. 48 in Portland& WMTW Ch.46 in Poland Springs)					0
48	PORTLAND	ME	W66CL	7.5	Low power TV/Translator	0
49	Can not be used (adj. to W66CL Ch. 48 in Portland)					0
50						1
51						1
					Sub Total	23
	Out of Core Licensees (Ch.52- 69)					
	PORTLAND	ME	W58CM	7.5	Low power TV/Translator	-1
	PORTLAND	ME	W57AP	7.5	Low power TV/Translator	-1
	DURHAM	NH	WENH-TV	58.3	Full Power Digital TV	-1
	DOVER	NH	NEW	46.5	Full Power Digital TV	-1
					Total No. of Ch. available	19

OMAHA, NE

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11						1
12						1
13						1
14						1
15						1
16	Can not be used (adj. to KYNE Ch. 17 in Omaha)					0
17	OMAHA	NE	KYNE-TV	3.7	Full Power Digital TV	0
18	Can not be used (adj. to KYNE Ch. 17 & K31ED Ch. 19 in Omaha)					0
19	OMAHA	NE	K31ED	5.2	Low Power TV/Translator	0
20	OMAHA	NE	KETV	5.7	Full Power Digital TV	0
21	Can not be used (adj. to KETV Ch. 20 & WOWT Ch. 22 in Omaha)					0
22	OMAHA	NE	WOWT-TV	5.8	Full Power Digital TV	0
23	Can not be used (adj. to K68AV Ch. 22 in Blair & WOWT Ch. 22 in Omaha)					0
24	BLAIR	NE	K68AV	21.2	Low Power TV/Translator	0
24	OMAHA	NE	KKAZ-CA	2.4	Class A TV	0
25	LINCOLN	NE	KOLN	71.0	Full Power Digital TV	0
26	Can not be used (adj. to KOLN Ch. 25 in Lincoln)					0
27						1
28						1
29	Can not be used (adj. to K45 EE Ch. 30 in Council Bluffs)					0
30	COUNCIL BLUFFS	IA	K45EE	5.2	Low Power TV/Translator	0
31	LINCOLN	NE	KLKN	74.7	Full Power Digital TV	0
32	Can not be used (adj. to KLKN Ch. 31 in Lincoln & KBIN Ch. 33 in Council Bluff))					0
33	COUNCIL BLUFFS	IA	KBIN-TV	5.2	Full Power Digital TV	0
34	OMAHA	NE	KAZO-LP	2.4	Low Power TV/Translator	0
35	RED OAK	IA	KHIN	35.3	Full Power Digital TV	0
36	Can not be used (adj. to KHIN Ch. 35 in Red Oak)					0
37	Reserved for Radio Telescope					0
38	OMAHA	NE	KXVO	19.5	Full Power Digital TV	0
39	Can not be used (adj. to KXVO Ch. 38 in Omaha & KUON Ch. 40 in Lincoln)					0
40	LINCOLN	NE	KUON-TV	27.7	Full Power Digital TV	0
41	Can not be used (adj. to KUON Ch. 40 in Lincoln)					0
42	Can not be used (adj. to KPTM Ch. 43 in Omaha)					0
43	OMAHA	NE	KPTM	19.5	Full Power Digital TV	0
44	Can not be used (adj. to KPTM Ch. 43 & KMTV Ch. 45 in Omaha)					0
45	OMAHA	NE	KMTV	5.6	Full Power Digital TV	0
46	Can not be used (adj. to KMTV Ch. 45 in Omaha)					0
47	Can not be used (adj. to KOHA Ch. 48 in Omaha)					0
48	OMAHA	NE	KOHA-LP	5.8	Low Power TV/Translator	0
49	Can not be used (adj. to KOHA Ch. 48 & KVSS Ch.50 in Omaha)					0
50	OMAHA	NE	KVSS-LP	5.3	Low Power TV/Translator	0
51	Can not be used (adj. KVSS Ch.50 in Omaha)					0
					Sub Total	13
	Out of Core Licensees (Ch.52- 69)					
	COUNCIL BLUFFS	IA	K52GP	5.2	Low Power TV/Translator	-1
	OMAHA	NE	K53EY	7.0	Low Power TV/Translator	-1
	COUNCIL BLUFFS	IA	K54GL	5.2	Low Power TV/Translator	-1
	OMAHA	NE	K61GA	0.1	Low Power TV/Translator	-1
					Total No. of Ch. available	9

Columbia, SC

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7	Can not be used (adj. to WOLO Ch.8 in Columbia)					0
8	COLUMBIA	SC	WOLO-TV	17.5	Full Power Digital TV	0
9	Can not be used (adj. to WOLO Ch.8 in Columbia)					0
10						1
11						1
12						1
13						1
14	Can not be used (adj. to WNSC Ch.15 in Rock Hill)					0
15	ROCK HILL	SC	WNSC-TV	58.0	Full Power Digital TV	0
16	Can not be used (adj. to WNSC Ch.15 in Rock Hill & WLTX Ch. 17 in Columbia)					0
17	COLUMBIA	SC	WLTX	16.8	Full Power Digital TV	0
18	GREENWOOD	SC	WNEH	69.7	Full Power Digital TV	0
19	Can not be used (adj. to WNEH Ch.18 in Greenwood)					0
20	Can not be used (adj. to W21CA Ch.21 in Columbia)					0
21	COLUMBIA	SC	W21CA	5.0	Low Power TV/Translator	0
22	Can not be used (adj. to W21CA Ch. 21 in Columbia)					0
23						1
24						1
25						1
26						1
27	Can not be used (adj. to WRLA Ch.28 in Sumter)					0
28	SUMTER	SC	WRJA-TV	44.6	Full Power Digital TV	0
29	Can not be used (adj. to WRLA Ch.28 in Sumter & WAGT Ch. 30 in Augusta)					0
30	AUGUSTA	GA	WAGT	61.6	Full Power Digital TV	0
31	AUGUSTA	GA	WRDW-TV	61.8	Full Power Digital TV	0
31	ORANGEBURG	SC	W31BS	16.5	Low Power TV/Translator	0
32	COLUMBIA	SC	WRLK-TV	9.9	Full Power Digital TV	0
33	ALLENDALE	SC	WEBA-TV	59.9	Full Power Digital TV	0
34	Can not be used (adj. to WEBA Ch.33 in Allendale)					0
35						1
36						1
37	Reserved for Radio Telescope					0
38	Can not be used (adj. to W39CI Ch.39 in Columbia)					0
39	COLUMBIA	SC	W39CL	8.3	Low Power TV/Translator	0
39	SUMTER	SC	WBHQ	17.5	Full Power Digital TV	0
40	Can not be used (adj. to WBHQ Ch.39 in Sumter & WIS Ch. 41 in Columbia)					0
41	COLUMBIA	SC	WIS	18.1	Full Power Digital TV	0
42	AUGUSTA	GA	WJBF	61.6	Full Power Digital TV	0
43	SPARTANBURG	SC	WRET-TV	75.8	Full Power Digital TV	0
44	Can not be used (adj. to WRET Ch.43 in Spartanburg & WJPM Ch. 45 in Florence)					0
45	FLORENCE	SC	WJPM-TV	76.3	Full Power Digital TV	0
46	Can not be used (adj. to WJPM Ch. 45 in Florence)					0
47	Can not be used (adj. to WACH Ch. 48 in Columbia)					0
48	COLUMBIA	SC	WACH	17.5	Full Power Digital TV	0
49	Can not be used (adj. to WACH Ch. 48 in Columbia)					0
50	Can not be used (adj. to WFXG Ch. 51 in Augusta)					0
51	AUGUSTA	GA	WFXG	61.1	Full Power Digital TV	0
					Sub Total	12
	Out of Core Licensees (Ch.52- 69)					
	COLUMBIA	SC	W67DP	12.2	Low Power TV/Translator	-1
					Total No. of Ch. available	11

Jackson, MS

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7	Can not be used (Adj. to WBXK Ch. 8 in Jackson)					0
8	JACKSON, ETC.	MS	WBXK-CA	6.5	Class A TV	0
9	JACKSON	MS	WLBT	12.9	Full Power Digital TV	0
10	JACKSON	MS	WBMS-CA	12.9	Class A TV	0
11	Can not be used (Adj. to WBMS Ch. 10 in Jackson)					0
12						1
13						1
14						1
15						1
16						1
17	Can not be used (Adj. to WMAU Ch. 18 in Bude)					0
18	BUDE	MS	WMAU-TV	72.1	Full Power Digital TV	0
19	Can not be used (Adj. to WMAU Ch. 18 in Bude & WMPN Ch. 20 in Jackson)					0
20	JACKSON	MS	WMPN-TV	14.9	Full Power Digital TV	0
21	JACKSON	MS	WAPT	6.6	Full Power Digital TV	0
22	Can not be used (Adj. to WBXK Ch. 21 & W23BC Ch.23 in Jackson)					0
23	JACKSON	MS	W23BC	1.3	Low Power TV/Translator	0
24	Can not be used (Adj. to W23BC Ch.23 in Jackson & WMAO Ch. 25 in Greenwood)					0
25	GREENWOOD	MS	WMAO-TV	77.2	Full Power Digital TV	0
26	Can not be used (Adj. to WMAO Ch. 25 in Greenwood)					0
27	Can not be used (Adj. to WDAM Ch. 28 in Laurel)					0
28	LAUREL	MS	WDAM-TV	78.7	Full Power Digital TV	0
29	Can not be used (Adj. to WDAM Ch. 28 in Laurel)					0
30						1
31	Can not be used (Adj. to WABG Ch. 32 in Greenwood)					0
32	GREENWOOD	MS	WABG-TV	77.1	Full Power Digital TV	0
33	Can not be used (Adj. to WABG Ch. 32 in Greenwood)					0
34	Can not be used (Adj. to WUFX Ch. 35 in Vicksburg)					0
35	VICKSBURG	MS	WUFX	25.4	Full Power Digital TV	0
36	Can not be used (Adj. to WUFX Ch. 35 in Vicksburg)					0
37	Reserved for Radio Telescope					0
38						1
39						1
40	Can not be used (Adj. to WDBD Ch. 41 in Jackson)					0
41	JACKSON	MS	WDBD	12.9	Full Power Digital TV	0
42	Can not be used (Adj. to WDBD Ch. 41 in Jackson)					0
43	Can not be used (Adj. to WMAW Ch. 43 in Meridian)					0
44	MERIDIAN	MS	WMAW-TV	64.7	Full Power Digital TV	0
45	JACKSON	MS	WJMF-LP	6.5	Low Power TV/Translator	0
46	JACKSON/BRANDON	MS	W46CW	9.2	Low Power TV/Translator	0
47	Can not be used (Adj. to W46CW Ch. 46 in Jackson/Brandon)					0
48	Can not be used (Adj. to WJXF Ch. 49 in Jackson)					0
49	JACKSON	MS	WJXF-LP	6.5	Low Power TV/Translator	0
50	Can not be used (Adj. to WJXF Ch. 49 in Jackson)					0
51						1
					Sub Total	11
	Out of Core Licensees (Ch.52- 69)					
	JACKSON	MS	WJTV	13.4	Full Power Digital TV	-1
	JACKSON	MS	W43BH	3.5	Low Power TV/Translator	-1
	JACKSON	MS	WJKO-LP	6.2	Low Power TV/Translator	-1
					Total No. of Ch. available	8

BATON ROUGE, LA

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7	BATON ROUGE	LA	K07WE	1.1	Low PowerTV/Translator	0
8	Cannot be used (adj. to K07WE Ch.7 in Baton Rouge)					0
9						1
10	Cannot be used (adj. to WYES Ch.11 in New Orleans & KPBN Ch. 11 in Baton Rouge)					0
11	NEW ORLEANS	LA	WYES-TV	75.7	Full Power Digital TV	0
11	BATON ROUGE	LA	KPBN-LP	4	Low PowerTV/Translator	0
12	Cannot be used (adj. to WYES-TV Ch.11 NO & KPBN Ch. 13 in Baton Rouge)					0
13	BATON ROUGE	LA	WBRZ-TV	10.4	Full Power Digital TV	0
14	Cannot be used (adj. to WGNO Ch. 15 in New Orleans)					0
15	NEW ORLEANS	LA	WGNO	57.1	Full Power Digital TV	0
16	LAFAYETTE	LA	KADN	60.3	Full Power Digital TV	0
17	Cannot be used (adj.to WADN Ch.16 in Lafayette and WMAU-TV Ch.18 in Bude)					0
18	BUDE	MS	WMAU-TV	64.4	Full Power Digital TV	0
19	BATON ROUGE	LA	KZUP-CA	10.7	Class A TV	0
20	Cannot be used (adj. to KZUP-CA Ch.19 and WLPB ch. 21 in Baton Rouge)					0
21	BATON ROUGE	LA	WBRL-CA	10.7	Class A TV	o
21	NEW ORLEANS	LA	WHNO	72.7	Full Power Digital TV	0
22	Cannot be used (adj. to WHNO Ch. 21 in New Orleans & KLPB-TV Ch.22 in Lafayette)					0
23	LAFAYETTE	LA	KLPB-TV	64	Full Power Digital TV	0
24	SLIDELL	LA	WUPL	73.1	Full Power Digital TV	0
25	BATON ROUGE	LA	WLPB-TV	3.9	Full Power Digital TV	0
26	Cannot be used (adj. to WLPB-TV Ch. 25 in Baton Rouge)					0
27	Cannot be used (adj. To KATC Ch. 28 in Lafayette)					0
28	LAFAYETTE	LA	KATC	64.4	Full Power Digital TV	0
29	NEW ORLEANS	LA	WVUE	75.7	Full Power Digital TV	0
30	BATON ROUGE	LA	WLFT-CA	7.3	Class A TV	0
31	NEW ORLEANS	LA	WLAE-TV	74.9	Full Power Digital TV	0
32	Cannot be used (adj. to WLAE-TV Ch. 31 in New Orleans)					0
33	Cannot be used (adj. to WVLA Ch. 33 in Baton Rouge)					0
34	BATON ROUGE	LA	WVLA	10.7	Full Power Digital TV	0
35	Cannot be used (adj to WVLA Ch.33 in Baton Rouge & WWL-TV Ch. 35 in New Orleans)					0
36	NEW ORLEANS	LA	WWL-TV	72.7	Full Power Digital TV	0
37	Reserved for Radio Telescope					0
38	BATON ROUGE	LA	K23DZ	9.6	Low PowerTV/Translator	0
39	BATON ROUGE	LA	WBXH-CA	1.6	Class A TV	0
40	NEW ORLEANS	LA	WNOL-TV	75	Full Power Digital TV	0
41	BATON ROUGE	LA	KBTR-CA	1.3	Class A TV	0
42	HAMMOND	LA	WHMM-DT	74.9	Full Power Digital TV	0
43	NEW ORLEANS	LA	WDSU	75.6	Full Power Digital TV	0
44	Cannot be used (adj. to WDSU ch.43 in New Orleans & WGMB ch. 45 in Baton Rouge)					0
45	BATON ROUGE	LA	WGMB	10.7	Full Power Digital TV	0
46	BATON ROUGE	LA	WAFB	2.3	Full Power Digital TV	0
47	Cannot be used (adj.to WAFB Ch. 46 & K58GB Ch. 48 in Baton Rouge)					0
48	BATON ROUGE	LA	K58GB	10.7	Low PowerTV/Translator	0
49	Cannot be used (adj. to K56GB Ch. 48 in Baton Rouge & WPXLTV ch.50 in New Orleans)					0
50	NEW ORLEANS	LA	WPXL	73.1	Full Power Digital TV	0
50	NEW IBERIA	LA	NEW	49.1	Newly Granted Allotment	0
51	Cannot be used (adj. to new rulemaking grant in New Iberia, Ch.51)					
					Sub Total	3
.	**Out of Core Licensees (Ch.52- 69)**					
	LAFAYETTE	LA	KLFY-TV	64	Full Power Digital TV	-1
	BATON ROUGE	LA	K58GB	10.7	Low PowerTV/Translator	-1
	BATON ROUGE	LA	KBTR-CA	1.3	Low PowerTV/Translator	-1
					Total No. of Ch. available	0

TALLAHASSEE, FL

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	TALLAHASSEE	FL	WTWC-TV	24.9	Full Power Digital TV	0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5	PELHAM	GA	WABW-TV	25.9	Full Power Digital TV	0
6	Can not be used (adj. to WABW Ch. 5 in Pelham)					0
7	Can not be used (adj. to WJHG Ch. 8 in Panama City)					0
8	PANAMA CITY	FL	WJHG-TV	87.5	Full Power Digital TV	0
9	TALLAHASSEE	FL	WACX-LP	0.2	Low Power TV/Translator	0
10	Can not be used (adj. to WACX Ch. 9 in Tallahassee)					0
11	Can not be used (adj. to WFXL Ch.12 in Albany)					0
12	ALBANY	GA	WFXL	66.5	Full Power Digital TV	0
13	Can not be used (adj. to WFXL Ch.12 in Albany)					0
14						1
15						1
16	Can not be used (adj. to WABLXL Ch.17 in Albany)					0
17	ALBANY	GA	WALB	66.5	Full Power Digital TV	0
18	Can not be used (adj. to WABLXL Ch.17 in Albany & Ch.WMBB in Ch. 19 in Panama City))					0
19	PANAMA CITY	FL	WMBB	66.4	Full Power Digital TV	0
20	Can not be used (adj. to W21BK Ch.21 in Tallahassee & Ch.WMBB in Ch. 19 in Panama City))					0
21	TALLAHASSEE	FL	W21BK	3.8	Low Power TV/Translator	0
22	TALLAHASSEE	FL	WLTX-TV	24.4	Full Power Digital TV	0
23	Can not be used (adj. to WLTX Ch. 22 & WTLF Ch. 24 in Tallahassee)					0
24	TALLAHASSEE	FL	WTLF	9.0	Full Power Digital TV	0
25	Can not be used (adj. to WTLF Ch.24 in Tallahassee)					0
25						1
26						1
27						1
28						1
29						1
30						1
31	Can not be used (adj. to WFSU Ch.32 in Tallahassee)					0
32	TALLAHASSEE	FL	WFSU-TV	20.4	Full Power Digital TV	0
33	Can not be used (adj. to WFSU Ch.32 in Tallahassee)					0
34	Can not be used (adj. to W35BN Ch.35 in Tallahassee)					0
35	TALLAHASSEE	FL	W35BN	3.7	Low Power TV/Translator	0
36	Can not be used (adj. to W35BN Ch.35 in Tallahassee)					0
37	Reserved for Radio Telescope					0
38						1
39						1
40						1
41						1
42	Can not be used (adj. to WBXT Ch.43 in Tallahassee & WVAG Ch. 43 in Valdosta)					0
43	TALLAHASSEE	FL	WBXT-CA	3.7	Class A TV	0
43	VALDOSTA	GA	WVAG	74.3	Full Power Digital TV	0
44	Can not be used (adj. to WBXT Ch.43 & WVUP Ch. 45 in Tallahassee)					0
45	TALLAHASSEE	FL	WVUP-CA	10.5	Class A TV	0
46	THOMASVILLE	GA	WCTV	25.9	Full Power Digital TV	0
47	TALLAHASSEE	FL	WWWF-LP	3.7	Low Power TV/Translator	0
48	LIVE OAK	FL	WFXU	24.9	Full Power Digital TV	0
49	Can not be used (adj. to WFXU Ch.48 in Live Oak)					0
50						1
51						1
					Sub Total	14
	Out of Core Licensees (Ch.52- 69)					
	TALLAHASSEE	FL	WBXT-CA	3.9	Low Power TV/Translator	-1
	TALLAHASSEE	FL	WTBC-LP	3.4	Low Power TV/Translator	-1
					Total No. of Ch. available	12

RENO, NV

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5	Can not be used (adj. to KO6GB Ch. 6 in Verdi)					0
6	VERDI	NV	K06GB	7.1	Low Power TV/Translator	0
7	RENO	NV	KRNV	14.5	Full Power Digital TV	0
8	Can not be used (adj. to KRNV Ch. 7 in Reno & KOLO Ch. 9 in Reno)					0
9	RENO	NV	KOLO-TV	14.7	Full Power Digital TV	0
10	VERDI	NV	K10GP	7.1	Low Power TV/Translator	0
11	Can not be used (adj.to K10GP Ch. 10 in Verdi)					0
12	Can not be used (adj. to KTVN Ch, 13 in Reno)					0
13	RENO	NV	KTVN	14.5	Full Power Digital TV	0
14	INCLINE VILLAGE	NV	K14AJ	19.3	Low Power TV/Translator	0
15	RENO	NV	KNPB	3.6	Full Power Digital TV	0
16	TAHOE CITY	CA	K23TX- TV	14.9	Low Power TV/Translator	0
17	CARSON CITY	NV	K17CA-TV	18.7	Low Power TV/Translator	0
18	Can not be used (adj. To K17CA Ch. 17 in Carson City & K19CU Ch. 19 in Reno)					0
19	CARSON CITY	NV	K19CU	18.6	Low Power TV/Translator	0
20	RENO	NV	KAME-TV	3.7	Full Power Digital TV	0
21	Can not be used (adj.to KAME Ch.20 in Reno)					0
22	Can not be used (adj. to K23TX Ch.23 in Tahoe City)					0
23	TAHOE CITY	CA	K23TX- TV	14.9	Low Power TV/Translator	0
24	Can not be used (adj.to K23TX Ch. 23 in Tahoe City & KRRI Ch.25 in Reno)					0
25	RENO	NV	KRRI-LP	3.7	Low Power TV/Translator	0
26	RENO	NV	KREN-TV	14.7	Full Power Digital TV	0
27	Can not be used (adj. to KREN Ch.26 in Reno)					0
28	Can not be used (adj. to K29ES Ch. 29 in Carson City)					0
29	CARSON CITY	NV	K29ES	20.9	Low Power TV/Translator	0
29	SILVER SPRINGS	NV	K29BN	26.2	Low Power TV/Translator	0
30	VERDI & MOGEL	NV	K30HY	7.1	Low Power TV/Translator	0
31	Can not be used (adj. to K30HY Ch. 30 in Verdi & K57CV Ch. 32 in Carson City)					0
32	CARSON CITY	NV	K57CV	18.6	Low Power TV/Translator	0
33	VERDI	NV	K33ER	7.1	Low Power TV/Translator	0
34	Can not be used (adj.to K33ER Ch. 33 in Verdi & K35FL Ch,35 in Silver Springs)					0
35	SILVER SPRINGS	NV	K35FL	26.1	Low Power TV/Translator	0
36	Can not be used (adj.to K35FL in Silver Springs)					0
37	Reserved for Radio Telescope					0
38	Can not be used (adj. to K39FF Ch. 39 in Reno)					0
39	RENO	NV	K39FF	3.7	Low Power TV/Translator	0
40	Can not be used (adj. to K39FF Ch. 39 in Reno & KNW CH. 41 in Reno)					0
41	RENO	NV	KNVV-LP	14.9	Low Power TV/Translator	0
42	Can not be used (adj. to KNW Ch. 41 & KELM Ch. 43 in Reno)					0
43	RENO	NV	KELM-LP	3.7	Low Power TV/Translator	0
44	RENO	NV	KRXI-TV	7.0	Full Power Digital TV	0
45	Can not be used (adj. to KRXI Ch. 44 & KAZR Ch. 46 in Reno)					0
46	RENO, ETC	NV	KAZR-CA	14.7	Class A TV	0
47	Can not be used (adj. To KAZR Ch. 46 in Reno & KNCV Ch. 48 in Carson City)					0
48	CARSON CITY, ETC.	NV	KNCV-LP	18.8	Low Power TV/Translator	0
49	STEAD, ETC.	NV	K49CK	7.1	Low Power TV/Translator	0
50	NORTH SHORE LAKE TAH	NV	K50CM	14.7	Low Power TV/Translator	0
51	VERDI	NV	K51DJ	7.1	Low Power TV/Translator	0
					Sub Total	0
	Out of Core Licensees (Ch.52- 69)					
	RENO	NV	K52FF	3.7	Low Power TV/Translator	-1
	VERDI	NV	K54DA	7.1	Low Power TV/Translator	-1
	NIXON	NV	K56IG	23.3	Low Power TV/Translator	-1
	CARSON CITY	NV	K57CV	18.6	Low Power TV/Translator	-1
	CRYSTAL BAY	NV	K58AO	22.4	Low Power TV/Translator	-1
	RENO, ETC.	NV	KAZR-Cla	14.7	Low Power TV/Translator	-1
					Total No. of Ch. available	0 (-6)

Fargo, ND

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FARGO	ND	KVNJ-LP	3.3	Low Power TV/Translator	0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5						1
6						1
7						1
8						1
9						1
10						1
11						1
12						1
13						1
14						1
15	Can not be used (Adj. to KCGE Ch. 16 in Crookston)					0
16	CROOKSTON	MN	KCGE-DT	76.4	Full Power Digital TV	0
17	Can not be used (Adj. to KCGE Ch. 16 in Crookston)					0
18	Can not be used (Adj. to KVRR Ch. 19 in Fargo)					0
19	FARGO	ND	KVRR	30.0	Full Power Digital TV	0
20	Can not be used (Adj. to KVRR Ch. 19 & WDAY Ch. 21 in Fargo)					0
21	FARGO	ND	WDAY-TV	21.4	Full Power Digital TV	0
22	Can not be used (Adj. to KFME Ch. 23 & WDAY Ch. 21 in Fargo)					0
23	FARGO	ND	KFME	21.3	Full Power Digital TV	0
24	Can not be used (Adj. to KFME Ch. 23 in Fargo)					0
25						1
26						1
27						1
28						1
29						1
30						1
31						1
32	Can not be used (Adj. to KVNJ Ch. 33 in Fargo)					0
33	FARGO	ND	KVNJ-LP	3.3	Low Power TV/Translator	0
34	Can not be used (Adj. to KVNJ Ch. 33 & K56ET Ch. 35 in Fargo)					0
35	FARGO	ND	K56ET	11.8	Low Power TV/Translator	0
36	Can not be used (Adj. to K56ET Ch. 35 in Fargo)					0
37	Reserved for Radio Telescope					0
38	VALLEY CITY	ND	KXJB-TV	38.0	Full Power Digital TV	0
39	Can not be used (Adj. to KXJB Ch. 38 in Valley City)					0
40						1
41						1
42						1
43	Can not be used (Adj. to KVLY Ch. 44 in Fargo)					0
44	FARGO	ND	KVLY-TV	39.8	Full Power Digital TV	0
45	Can not be used (Adj. to KVLY Ch. 44 in Fargo)					0
46						1
47						1
48						1
49						1
50						1
51						1
					Sub Total	26
	Out of Core Licensees (Ch.52- 69)					
					Total No. of Ch. available	26

Helena, ND

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					0
3	FCC NPRM preclude use					0
4	FCC NPRM preclude use					0
5	BUTTE	MT	KXLF-TV	44.9	Full Power Digital TV	0
6	Can not be used (Adj. to KXLF Ch. 5 in Butte)					0
7	Can not be used (Adj. to K08KT Ch. 8 in Boulder)					0
8	BOULDER	MT	K08KT	23.9	Low power TV/Translator	0
8	GREAT FALLS	MT	KFBB-TV	74.1	Full Power Digital TV	0
9	Can not be used (Adj. to K08KT Ch. 8 in Boulder & KFBB Ch. 8 in Great Falls)					0
10						1
11						1
12	Can not be used (Adj. to K13KP Ch.13 in Boulder)					0
13	BOULDER	MT	K13KP	23.0	Low power TV/Translator	0
14	HELENA	MT	KTVH	22.3	Full Power Digital TV	0
15	Can not be used (Adj. to KTVH Ch.14 in Helena))					0
16						1
17						1
18	Can not be used (Adj. to KWYB Ch. 19 in Butte)					0
19	BUTTE	MT	KWYB	44.9	Full Power Digital TV	0
20	Can not be used (Adj. to KWYB Ch. 19 in Butte & KHBB in Helena)					0
21	HELENA	MT	KHBB-LP	12.2	Low power TV/Translator	0
22	BUTTE	MT	K22HD	21.4	Low power TV/Translator	0
23	Can not be used (Adj. to K22HD Ch. 22 in Butte)					0
24	Can not be used (Adj. to KXLH Ch. 25 in Helena)					0
25	HELENA	MT	KXLH-LP	12.2	Low power TV/Translator	0
26	Can not be used (Adj. to KXLH Ch. 25 in Helena & K27CD Ch. 27 in Boulder)					0
27	BOULDER	MT	K27CD	23.7	Low power TV/Translator	0
28	Can not be used (Adj. to KMTF Ch. 29 in Helena & K27CD Ch. 27 in Boulder)					0
29	HELENA	MT	KMTF	22.3	Full Power Digital TV	0
30	Can not be used (Adj. to KMTF Ch. 29 in Helena)					0
31						1
32	Can not be used (Adj. to KTVM Ch. 33 in Butte)					0
33	BUTTE	MT	KTVM	44.9	Full Power Digital TV	0
34	HELENA	MT	KJJC-LP	12.2	Low power TV/Translator	0
35	Can not be used (Adj. to KJJC Ch. 34 in Helena & K36Cx Ch. 36 in Clancy)					0
36	CLANCY	MT	K36CX	7.5	Low power TV/Translator	0
37	Reserved for Radio Telescope					0
38						1
39						1
40						1
41						1
42						1
43	Can not be used (Adj. to K44GE Ch. 44 in Helena)					0
44	HELENA	MT	K44GE	2.4	Low power TV/Translator	0
45	GREAT FALLS	MT	KTGF	76.9	Full Power Digital TV	0
46	HELENA	MT	K58II	12.5	Low power TV/Translator	0
47	Can not be used (Adj. to K58II Ch. 46 in Helena)					0
48						1
49						1
50						1
51						1
					Sub Total	14
	Out of Core Licensees (Ch.52- 69)					
					Total No. of Ch. available	14

Junea, AK

Ch.	City	State	Call	Miles Away	Type	Available Ch.
2	FCC NPRM preclude use					
3	FCC NPRM preclude use					
4	FCC NPRM preclude use					
5	JUNEAU-DOUGLAS	AK	KATH-LP	0.4	Low Power TV/Translator	0
6	MENDENHALL VALLEY, E	AK	K06JZ	8.9	Low Power TV/Translator	0
7						1
8						1
9	Can not be used (adj. to KTOO Ch. 10 in Juneau)					0
10	JUNEAU	AK	KTOO-TV	0.7	Full Power Digital TV	0
10	LEMON, ETC.	AK	K10LS	5.0	Low Power TV/Translator	0
11	JUNEAU	AK	KJUD	0.7	Full Power Digital TV	0
12	Can not be used (adj. to KJUD Ch. 11 in Juneau & K1OC Ch. 12 in Douglas)					0
13	DOUGLAS, ETC.	AK	K13OC	2.2	Low Power TV/Translator	0
14	Can not be used (adj. to KCBJ-LP Ch. 15 in Juneau)					0
15	JUNEAU	AK	KCBJ-LP	0.7	Low Power TV/Translator	0
16	Can not be used (adj. to KCBJ-LP Ch. 15 & K17HC Ch. 17 in Juneau)					0
17	JUNEAU	AK	K17HC	0.2	Low Power TV/Translator	0
18	Can not be used (adj. to K17HC Ch. 17 in Juneau)					0
19						1
20						1
21						1
22						1
23	Can not be used (adj. to K24HB Ch. 24 in Juneau)					0
24	JUNEAU	AK	K24HB	2.7	Low Power TV/Translator	0
25	Can not be used (adj. to K24HB Ch. 24 & K26IB Ch. 26 in Juneau)					0
26	JUNEAU	AK	K26IB	2.7	Low Power TV/Translator	0
27	Can not be used (adj. to K26IB Ch. 26 in Juneau)					0
28						1
29						1
30						1
31						1
32						1
33						1
34						1
35						1
36						1
37	Reserved for Radio Telescope					0
38						1
39						1
40						1
41						1
42						1
43						1
44						1
45						1
46						1
47						1
48						1
49						1
50						1
51						1
					Total No. of Ch. Available	29

Comments on DA-06-1920
September 26, 2006
Issued by Donna C. Gregg, Chief, Media Bureau

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The original ruling may be found at:
http://hraunfoss.fcc.gov/edocs_public/attachmatch/DA-06-1920A1.pdf

For background details, visit the web site for the client of Atty. Friedman, www.drrts.com.

For the actual request submitted by Atty. Friedman, see the attached Exhibit A.

The letter ruling issued by the Chief of the Media Bureau is frought with problems.

1. From www.drrts.com, I learn that the petition involves an AM radio station. Yet the letter ruling refers to "new broadcast television towers." As Friedman's file is labeled "Damascus1.pdf," it is obvious that his client opposes the Damascus AM broadcast towers, not a TV tower. Yet Friedman's request was broad, and not limited to AM, to FM or to TV. Where on earth did Donna Gregg get the idea that he was "addressing the construction of new broadcast television towers"? Order at ¶2. Friedman didn't represent a group opposing a TV tower, and he never mentions TV.

2. As Atty. David Siddall points out, local zoning authorities are not warned that "broadcast" is a term of art, and consequently the ruling does not apply to cellular towers, amateur radio towers, and so forth. This could prove to be a huge problem at the local level, due to inadequate explication. Zoning authorities not versed in FCC language are not referred to a definition (either by suggesting a term of art through the use of a capital letter, or reference to a USC or CFR section). There is reason to fear that local zoning authorities, unused to the terminology, could confuse amateur radio with "broadcasting."

3. In 1997, the question of preemption of local zoning was the subject of a petition for a rulemaking by the Association for Maximum Service Television. http://www.fcc.gov/Bureaus/Mass_Media/Notices/1997/fcc97296.pdf. The matter was subject to full filings on many related issues. No ruling was ever issued. Friedman specifically calls attention to an unresolved RULEMAKING proceeding, yet the answer appears in the form of a DA order. This one page order may be seen by some, who are unschooled in FCC matters, as to effectively resolve the 1997 proceeding, without ever having received a Commission vote. The Media Bureau has opened a HUGE can of worms, without any opportunity for opposing views to be heard. Letter rulings are supposed to confirm existing policy. Given the fact that the AMSTV petition never reached a ruling stage, this ruling appears substantive, and not merely a restatement.

4. The letter speaks to the preservation of "agriculturally zoned land and scenic vistas."

a. We have no idea as to what the definition of a "scenic vista" may be, nor do we know whether this represents the view ***from*** the site, or the view ***to*** the site. This letter ruling virtually invites local zoning authorities to bypass, perhaps ignore, the SHPO (State Historic Preservation Office) process of the NEPA (National Environmental Policy Act) of 1969.

b. There is a huge public policy issue with respect to tall towers (let's define that as towers over 200 feet tall). The question must be asked: If you can't put a tower on agriculturally zoned land, and no parcels large enough exist in commercially zoned areas, and the town may have no industrially zoned land (which is true of my town of Lincoln, MA), and there is no "broadcast overlay district," and no parcels large enough in residential areas, then the consequence is that broadcast (whether AM, FM or TV) antennas may be effectively prohibited. Surely it was never the intention of the Congress or the Commission to allow the prohibition of local coverage. Yet there is good reason to fear that effective prohibition will be the outcome in many communities. This would be in direct conflict with the basis and purpose of the FCC, as found in the Communications Act, which is "to ***provide*** for the use of [radio transmission channels]." (*Emphasis added.)*

5. There is a huge leap between saying that the FCC has not preempted, and the FCC "would not." Gregg does not underline the point that the FCC has not in the past acted, but is not committing itself to not preempting in the future. Yet a casual reader would assume that "the FCC would not."

6. Was there a Public Notice of the matter? Lesser matters than this have warranted a Public Notice.

7. While the original request acknowledges a statutory preemption for CMRS under 47 USC §332, and the Commission's OTARD order, it does not mention the preemption for amateur radio towers in 47 CFR §97.15 (b), arising out of "PRB-1." Furthermore, there is no discussion of the implied preemption for AM broadcast towers (the very subject of the Damascus situation) upon which a state supreme court has ruled. *Koor Communication v. City of Lebanon*, 148 N.H. 618 (2002). None of these ***four*** preemptions (CMRS, OTARD, ham, AM) of local zoning is mentioned in Gregg Order.

Conclusion: Given the mistake contained in the letter, the lingering AMSTV petition never brought to conclusion, and the huge public policy issues, and the possibility that the letter could be misread by those unschooled in FCC law, reconsideration would be appropriate.

Exhibit A

THOMPSON HINE

BRUSSELS CINCINNATI CLEVELAND COLUMBUS DAYTON NEW YORK WASHINGTON, D.C.

September 26, 2005

RETURN WITH DATE-STAMP

Ms. Marlene H. Dortch
Secretary
Federal Communications Commission
445 12th Street, S.W.
Washington, D.C. 20554

RECEIVED

SEP 2 6 2005

Federal Communications Commission
Office of Secretary

Re: **Request for Declaratory Ruling**

Dear Ms. Dortch:

We are writing to request, pursuant to Section 1.2 of the Commission's Rules, the issuance of a declaratory ruling as to whether the Commission would preempt the legislative efforts of a local jurisdiction in adopting modifications to its zoning ordinance that restrict the construction of new broadcast towers in order to preserve land for agricultural uses and to protect scenic vistas associated with currently undeveloped areas.

This office represents a non-profit citizens group that is participating in the development of legislation to deal with the construction of new broadcast towers through modification of the local county's zoning ordinance. In connection with that process, our client has suggested to the county legislators that they restrict the construction of new broadcast towers in certain rural areas and that they impose height restrictions in other parts of the county where new broadcast towers would be permitted to be constructed. During the debate over the legislation, the question has arisen as to whether the Commission, if requested, would preempt such legislation.

We are aware that the Communications Act of 1934, as amended, contains provisions, in Section 332, that allow federal courts to override local zoning restrictions on towers intended for personal wireless services. In addition, the Commission has preempted local restrictions on personal receive-only satellite dishes used for receiving DBS programming.

However, to the best of our knowledge, the Commission has not preempted or restricted local restrictions on broadcast towers. In fact, a review of Commission decisions evidences a clear desire to defer to local officials on such matters. While the Commission did commence a rulemaking proceeding, in 1997, to consider whether it should exercise preemptive powers, and in what manner, over local broadcast siting, it has elected not to render a decision on this subject.

Consequently, we hereby request that a declaratory ruling be provided to assist local legislators by advising them that, under the current policy of the FCC, local zoning rules which are predicated on land use preservation, including the preservation of

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agriculturally-zoned land and scenic vistas, would not be preempted by the Commission.

Respectfully submitted,

Barry A. Friedman

cc: Mr. Roy J. Stewart
Senior Deputy Chief
Media Bureau