Wednesday, November 24, 2004

Dear Sir or Madam:

Please find below the Wireless Internet Service Providers Association (WISPA) comments to the NOTICE OF PROPOSED RULE MAKING Unlicensed Operation in the TV Broadcast Bands – ET Docket No. 04-186.

Thank you, for this opportunity to comment on the Commissions Notice of Proposed Rule Making. We look forward to your ruling granting unlicensed use of the unused Broadcast TV spectrum in the near future.

The Wireless Internet Service Providers shall use this spectrum with the utmost care and consideration of the Broadcast industry, their viewers, and the best interests of the public at large.

Sincerely,

Wireless Internet Service Providers Association (WISPA)

EXECUTIVE SUMMERY
To Comments by the Wireless Internet Service Providers Association, WISPA

NOTICE OF PROPOSED RULE MAKING
Unlicensed Operation in the TV Broadcast Bands – ET Docket No. 04-186

WISPA (Wireless Internet Service Providers Association) hereinafter referred to as "We" strongly supports Unlicensed Wireless Operation in the TV Broadcast Bands and request that a low power unlicensed underlay be allocated on the broadcast TV Spectrum, channels 2-69.

Current operations in the bands at 900 MHz and above limit the ability of Wireless Internet Service Providers (WISPS) to adequately provide service to areas where there is heavy arboreal foliage. The dispersive effects of arboreal foliage cause approximately 1 dB/ft. attenuation at 2.45 GHz as the signal passes through typical arboreal foliage. The spectrum above 900 MHz does not work well in heavy arboreal foliage or where direct line of sight is not possible.

Specifically, the unlicensed spectrum above 930 MHz (2.45 GHz and above) becomes of little value where trees obscure the potential Wireless user by 50 feet linear penetration at distances over 1/2 mile. The situation improves in the unlicensed spectrum at 900 MHz (902-928 MHz) to 200-300 linear feet of arboreal foliage and slightly less than 3 miles path length, but line of sight is generally still required.

Operations in the TV Channel Spectrum below 700 MHz will allow users to access the unlicensed signals regardless of the amount of arboreal foliage along a transmission path. Providing universal coverage to all members of any coverage area.

The impact of universal coverage on small, rural, economically deprived communities will be measurable. The ability of small businesses to provide competitive services with businesses located in more advantaged urban, and suburban, areas of the country increase the economic viability of these rural communities.

Every WISP has seen the development of small office, home office (SOHO) businesses since the implementation of their wireless services. Additionally, the ability of existing small manufacturing businesses to compete for lucrative contracts and increase employment opportunities as a result of Broadband Access in these communities is evidence enough to convince the Commission to approve the PROPOSED RULE MAKING for Unlicensed Operation in the TV Broadcast Spectrum.

Citizens choosing to live in the very attractive rural areas of the United States must not be disadvantaged in their ability to access the very technologies that can lift the economic development of these areas.

WISPA urges the Commission in the strongest possible terms to adopt the proposed rule making and allow unlicensed operation of telecommunications devices in the unused TV Spectrum, channels 2-69.

WISPA applauds this effort of the commission to bring the telecommunications technology revolution to the underserved, under developed areas of the United States.

Before the
Federal Communications Commission
Washington, D.C. 20554

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

NOTICE OF PROPOSED RULE MAKING

Adopted: May 13, 2004 **Released: May 25, 2004**

By the Commission: Chairman Powell; Commissioners Copps and Adelstein issuing separate statements; Commissioner Martin concurring and issuing a statement.

Comment date: [75 days from publication in Federal Register]
Reply comment date: [105 days from publication in Federal Register]

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I. INTRODUCTION

1. By this Notice, we propose to allow unlicensed radio transmitters to operate in the broadcast television spectrum at locations where that spectrum is not being used. We believe that the proposals set forth herein would provide for more efficient and effective use of the TV spectrum and would have significant benefits for the public by allowing the development of new and innovative types of unlicensed broadband devices and services for businesses and consumers. Further, new unlicensed broadband operations may provide synergy with traditional broadcast operations and offer broadcasters the opportunity to provide new services. In addition, because transmissions in the TV band are subject to less propagation attenuation than transmissions in the spectrum where existing broadband unlicensed operations are permitted, allowing unlicensed operation in the TV bands could benefit wireless internet service providers (WISPs) by improving the service range of their existing operations, thereby allowing WISPs to reach new customers.

Response:

We fully support this concept. Many WISPS' operate in rural, hilly, relatively forested regions of the rural U.S.; frequencies above 1 Ghz are severely diffracted by vegetation. Use of the lower frequencies in the TV Spectrum would enhance the delivery of service to rural subscribers not currently being served by any Broadband services.

2. We recognize that broadcasters are currently undergoing a transition to digital operation, during which channel availability is likely to change more frequently. Our approach will appropriately account for these changes. To ensure that no harmful interference to authorized users of the spectrum will occur, we propose to define when a TV channel is "unused" and to require these unlicensed devices comply with significant restrictions and technical protections. Unlicensed devices would be required to incorporate "smart radio" features to identify the unused TV channels in the area where they are located. We intend to consider several alternative methods for identifying the unused TV channels, including approaches that would: 1) allow existing television and/or radio stations to transmit information on TV channel availability directly to an unlicensed device; 2) employ geo-location technologies such as the Global Positioning Satellite (GPS) system; or 3) employ spectrum sensing techniques that would determine if the signals of authorized TV stations are present in an area.

Response:

This approach seems reasonable. *"Item 3) employ spectrum sensing techniques that would determine if the signals of authorized TV stations are present in an area."* **This may be accomplished using a spectrum analyzer, to measure the presence of broadcast signals within an area preauthorized for use by unlicensed devices. Careful engineering and planning and adequate RF flux density surveys will identify permissible operating environments for unlicensed devices.**

II. BACKGROUND

3. The Commission provides for the operation of unlicensed radio transmitters under Part 15 of its rules.[1] Under these rules, such devices generally operate on frequencies shared with authorized

[1] *See* 47 C.F.R. Part 15.

services and at relatively low power. Operation under Part 15 is subject to the condition that the device does not cause harmful interference to authorized services, and that it must accept any interference received.[2] The current Part 15 rules provide substantial flexibility in the types of unlicensed devices that can be operated. However, the rules prohibit the operation of unlicensed devices on certain frequencies, including almost all of the bands used for broadcast television service.[3]

Response:

If the commission maintains the provisions that: *"such devices generally operate on frequencies shared with authorized services and at relatively low power. Operation under Part 15 is subject to the condition that the device does not cause harmful interference to authorized services, and that it must accept any interference received.[4]"* **for this new frequency spectrum about to be made available. There can be no complaint, nor condemnation of the Commission, by existing carriers of other telecommunication services. Use of the TV spectrum by unlicensed devices operating at frequencies not employed in a given geographic area is good policy and increases the economically efficient use of the entire radio spectrum.**

4. The broadcast television service operates under Part 73 of the rules. TV stations operate on 6 megahertz channels designated channels 2 to 69 in the VHF and UHF portions of the radio spectrum (54-72 MHz, 76-88 MHz, 174-216 MHz and 470-806 MHz).[5] TV channel 37 is allocated for radio astronomy and the wireless medical telemetry service and is not used for TV broadcasting. The Commission is now in the process of requiring television stations to convert from analog to digital transmissions.[6] To accomplish this transition, the Commission has developed a new table of digital allotments for full service television stations.[7] During the transition to digital transmissions, each full service

[2] *See* 47 C.F.R. § 15.5. As defined in Section 2.1(c) of the Commission's rules and the international radio regulations, harmful interference is "interference which … seriously degrades, obstructs, of repeatedly interrupts a radiocommunication service operating in accordance with these [international] Radio Regulations. (RR)." *See* 47 C.F.R. § 2.1(c).

[3] *See* 47 C.F.R. §§ 15.205 and 15.209. Remote control and medical telemetry devices are the only unlicensed transmitters that are currently permitted to operate in the TV bands. *See* 47 C.F.R. §§ 15.231, 15.241 and 15.242.

[4] *See* 47 C.F.R. § 15.5. As defined in Section 2.1(c) of the Commission's rules and the international radio regulations, harmful interference is "interference which … seriously degrades, obstructs, of repeatedly interrupts a radiocommunication service operating in accordance with these [international] Radio Regulations. (RR)." *See* 47 C.F.R. § 2.1(c).

[5] *See* 47 C.F.R. § 73.603(a).

[6] Advanced Television Systems and Their Impact upon the Existing Television Broadcast Service, MM Docket 87-268, *Sixth Report and Order*, 12 FCC Rcd 14588 (1997).

[7] *See* 47 C.F.R. § 73.622. In developing the initial table of allotments for digital TV stations, the required separations to prevent interference between digital stations and between analog and digital stations were determined using minimum desired-to-undesired (D/U) signal ratios. *See* 47 C.F.R. § 73.623(c). New digital allotments added after the initial digital TV table of allotments must meet minimum separation distances to both digital and analog TV stations. *See* 47 C.F.R. § 73.623(d). Except for co-channel spacing requirements, digital TV stations alternatively may be co-located or separated by much shorter distances to analog or other digital TV stations. Generally, if such stations are separated by about 20 kilometers or less, the predicted signal levels have a sufficiently high D/U ratio between signals to avoid interference.

television station that was authorized before 1997 is required to broadcast on two channels; one digital and one analog. At the end of the transition, each station must cease analog operation and operate on a single digital channel. Because the new digital TV system is more spectrally efficient, some current TV channel protection requirements were relaxed or eliminated for digital operation, and fewer channels are required to accommodate all existing television stations after the digital transition. Digital television stations will operate only on channels 2-51 after the transition, and television channels 52-69 have been reallocated for other uses.[8]

Response:

We applaud the Commissions reallocation of these channel frequencies between 698 Mhz and 806 Mhz. The availability of this spectrum for use by unlicensed devices and the wireless internet service providers (WISPs) will be especially useful when attempting to serve the rural community in the eastern portions of the United States which are characterized by undulating terrain and is commonly heavily wooded.

5. In addition to full service analog and digital TV stations under Part 73 of the rules, certain other licensed services are permitted to operate on TV channels. Class A television stations operate under Subpart J of Part 73 of the rules.[9] Low power TV stations, TV translator and TV booster stations under Part 74 of the rules are permitted to operate on a secondary basis to full service and on an equal basis to Class A TV stations, provided they meet technical rules to prevent interference to reception of such stations.[10] Part 74 also permits certain broadcast auxiliary operations on TV channels 14-69 on a secondary basis.[11] In addition, Part 74 permits certain entities to operate wireless microphones on vacant TV channels on a non-interference basis.[12] Further, in 13 metropolitan areas, one to three channels in the range of 14-20 are used by the Private Land Mobile Radio Service (PLMRS) under Part 90 of the rules and the Commercial Mobile Radio Service (CMRS) under Part 20 of the rules. In addition, medical telemetry equipment is permitted to operate on an unlicensed basis on vacant TV channels 7-46, and remote control devices are allowed to operate on any TV channel above 70 MHz, except for channel 37.[13]

Response:

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[8] *See First Report and Order* in WT Docket No. 99-168, 15 FCC Rcd 476 (2000), *Report and Order* in ET Docket No. 97-157, 12 FCC Rcd 22953 (1998) and *Report and Order* in GN Docket No. 01-74, 17 FCC Fcd 1022 (2002).

[9] *See* 47 C.F.R. § Part 73 Subpart J. Class A TV stations operate at the power levels permitted for low power television stations under Part 74 of the rules, but have certain protection rights with respect to full service analog and digital TV stations not available to TV translator and low power stations.

[10] *See* 47 C.F.R. Part 74 Subpart G.

[11] *See* 47 C.F.R. § 74.602(h).

[12] *See* 47 C.F.R. § 74.861.

[13] *See* 47 C.F.R. §§ 15.231, 15.241 and 15.242. Effective October 16, 2002, the Commission ceased granting certification for new medical telemetry equipment that operates on TV channels, but there is no cutoff on the sale or use of equipment that was certified before that date. *See* 47 C.F.R. § 15.37(i). To provide spectrum for wireless medical telemetry equipment, the Commission established the Wireless Medical Telemetry Service to operate on a primary basis in 14 megahertz of spectrum in three blocks at 608-614 MHz (TV channels 37, which the WMTS now shares with radioastronomy), 1395-1499 MHz, and 1429-1432 MHz. *See Report and Order* in ET Docket No. 99-255, 15 FCC Rcd 11206 (2000).

The commission upholds a uniquely American tradition when it advocates the efficient use of our limited national resource of radio spectrum. Furthermore, there is no more compelling implementation of our radio spectrum than to encourage its efficient use by new and innovative services such as the budding wireless networking industry, popularly referred to as WISPs. The vital service they provide to the underserved and unserved rural areas of the US make possible an invigoratation of the economies of these underdeveloped areas. The example of efficient spectrum use of "*13 metropolitan areas, one to three channels in the range of 14-20 are used by the Private Land Mobile Radio Service (PLMRS) under Part 90 of the rules and the Commercial Mobile Radio Service (CMRS) under Part 20 of the rules."* **demonstrates the "good sense" that this proposed rule making fosters.**

6. On December 11, 2002, the Commission adopted a *Notice of Inquiry* (*Notice*) in this proceeding seeking comment on the possibility of allowing unlicensed devices to operate in the TV broadcast bands at locations and times when the spectrum is not being used by authorized services.[14] The Commission noted that unused portions of the TV spectrum appear to be a suitable choice for expanded unlicensed operations. In this regard, the Commission observed that there is significant bandwidth available because each TV channel occupies six megahertz and multiple channels are generally vacant or unused in a particular area. The Commission stated that allowing unlicensed devices to operate on unused TV channels would lead to more efficient use of the spectrum. Commenting parties representing the interests of manufacturers and users of unlicensed devices generally support this approach, while those representing the interests of the current users of the TV broadcast spectrum, both primary and secondary, express concern about potential interference from such new unlicensed operations. Parties submitting comments and/or reply comments are listed in Appendix A.

Response:

We concur with this statement and support the use of these frequencies for unlicensed devices.

III. DISCUSSION

7. Consistent with the significant growth of and consumer demand for unlicensed wireless broadband applications and services in recent years,WISPAbelieve that it is desirable to provide additional spectrum for the operation of unlicensed devices that support such applications and services. As suggested in the *Notice* and as discussed below,WISPAbelieve that unlicensed devices can successfully operate in the unused portions of the TV broadcast bands without causing harmful interference to television and other authorized services, provided appropriate technologies are used to ensure that such unlicensed devices operate only in vacant spectrum. We therefore are proposing to amend our rules to allow unlicensed devices to operate on unused frequencies in the broadcast TV bands. We believe that these proposals would provide opportunities for the development of new unlicensed wireless communications devices and systems and make more efficient use of the TV spectrum. Given the favorable propagation characteristics of the TV spectrum, these new devices could provide more

[14] See *Notice of Inquiry* in ET Docket No. 02-380, 17 FCC Rcd 25632 (2002). The Commission also sought comment on the possibility of allowing unlicensed devices to operate in the 3650-3700 MHz band with only the minimum restrictions necessary to prevent interference to authorized users of the band. However, the matter of unlicensed operation in the 3650-3700 MHz band is now being addressed in a separate proceeding. *See Notice of Proposed Rule Making* in ET Docket No. 04-151, FCC 04-100 (rel. April 23, 2004).

effective service at greater ranges than other unlicensed devices that operate at higher frequency bands. These new devices and services could also have significant benefits for economic development and for consumers and businesses by providing additional competition in the broadband market. We request comment on our tentative conclusions and proposals as set forth below. In particular, we seek comment and technical analyses relating to methods for avoiding interference to authorized services.

Response:

The unlicensed devices referred to remain to be developed, however, through the use of software deployed radios, now being referred to as cognitive radios, the unlicensed devices will be able to detect not only levels of interference, but the type of interference. That is to say these new cognitive radios shall be able to differentiate between a digital TV signal and another unlicensed device. This may be done by using digital "flags" in both type of transmissions to more quickly ID the type of transmission detected and avoid transmitting an interfering carrier. This could include a type of frequency hopping to other channels that are clear to transmit.

Notwithstanding, if "Cognitive Radio" becomes "the solution" for operation of unlicensed devices in the TV Spectrum; it should not limit the efforts of the FCC and industry that are currently engaged in opening new spectrum for use by unlicensed devices.

Finally, regarding hardware for 700 MHz and unused TV Spectrum. Last year a group of WISP operators met with commissioner Abernathy included in this group was Mr. Ed Wyatt from Alvarion, Inc. When the use of unused TV bands came up Mr. Wyatt pointed out that it was basically a software change to the 900 MHz Alvarion radios, that they are presently manufacturing, for these devices to operate in the TV bands. Therefore, hardware is available for operation in these TV Frequency bands with minor modifications.

8. We also believe that permitting unlicensed devices to use vacant TV channels would further the goals and efforts of Congress and the Commission to encourage and promote efficient and effective use of the radio spectrum. As set forth in Sections 303(g) and 309(j)(3)(D) of the Communications Act of 1934, as amended, Congress has established goals for the Commission to "[s]tudy new uses for radio, … , and generally encourage the larger and more effective use of the radio in the public interest" and to seek to promote "efficient and intensive use of the radio spectrum."[15] In furtherance of these statutory goals, the Commission has endeavored to review and revise its radio spectrum allocation, assignment, and operating rules and policies to ensure the fullest and most effective use of the radio spectrum. For example, in past actions, the Commission has established rules for promoting effective use of the spectrum through elimination of barriers to the development of secondary markets and instituted a program for recovery of 108 megahertz of spectrum now used by broadcast television part of that service's transition to digital operation.[16] More recently, the Commission has initiated proceedings to consider the use of an interference temperature metric to expand unlicensed radio

[15] *See* 47 U.S.C. 303(g) and 309(j)(3)(D).

[16] *See Report and Order and Further Notice of Proposed Rulemaking* in WT Docket No. 00-230, 18 FCC Rcd 20605 and *Sixth Report and Order* in MM Docket No. 87-268, 12 FCC Rcd 14588 (1007).

use in certain frequency bands and to allow the operation of unlicensed devices in the 3650-3700 MHz band.[17] Consistent with these efforts, the actions proposed herein would serve to make available for important new uses a significant amount of spectrum that would otherwise remain fallow.

Response:

We support the innovative adoption of use of all radio spectrum for new technologies and emerging services such as commercial wireless network services provided by the WISP industry.

A. Unlicensed Operation in the Broadcast TV Spectrum

9. Part 15 unlicensed devices and wireless broadband services using such devices have been extremely successful. The past few years have witnessed the development of broadband unlicensed industry standards such as IEEE 802.11b (Wi-Fi), Bluetooth, and Home RF that have greatly expanded the number and variety of devices that operate in the 2.4 GHz and 5 GHz industrial, scientific and medical equipment (ISM) bands.[18] These standards have enabled the introduction of a host of new wireless Internet products as well as wireless computer peripherals such as printers and keyboards, and wireless headsets and computer connections for cellular and PCS phones.

Response:

Continued expansion of available radio spectrum for use by Wireless Internet Service Providers, especially in the Broadcast TV Spectrum, will only further promote the continued technological development of services available to the public.

10. The record developed in response to the *Notice* indicates that there is need for additional spectrum for unlicensed broadband devices. A number of commenting parties in particular state that unlicensed devices should be allowed to operate in the TV broadcast bands. Intel submits that the propagation characteristics of these bands make them "highly suited" for a variety of uses, and that the fixed nature of TV transmitters makes it possible for unlicensed transmitters to co-exist in the same band.[19] Intel further states that unused spectrum, or "white spaces," that could be used by unlicensed devices exist even in apparently congested areas. It argues that this would permit unlicensed devices to provide valuable new services.[20] The Consumer Electronics Association (CEA) similarly states that there is capacity in the TV bands that could be tapped if unlicensed devices are built with new technologies appropriate for preventing interference.[21] It also states that new devices that would access TV spectrum

[17] *See Notice of Proposed Rulemaking* in ET Docket No. 03-237, 18 FCC Rcd 25310 (2003) and *Notice of Proposed Rulemaking* in ET Docket No. 04-151, FCC 04-100 (rel. April 23, 2004).

[18] These operating standards provide manufacturers with guidance for developing spread spectrum devices for the 2.4 GHz band. The IEEE 802.11b standard applies to direct sequence devices, while the Bluetooth and Home RF standards apply to frequency hopping devices.

[19] *See* Intel comments at 6.

[20] *See* Intel comments at 9.

[21] *See* CEA comments at 3-4.

on a non-interference basis could provide new services such as a return path for interactive broadcast services or wireless home video distribution.[22] The Information Technology Industry Council (ITI) believes that the use of the TV bands is feasible, subject to reasonable requirements for compatibility. It states that the TV bands offer ample spectrum suitable for last mile broadband solutions. ITI also indicates that the characteristics of spectrum below 1 GHz could solve some of the current distance and coverage issues associated with unlicensed broadband devices.[23] In addition, a number of WISPs filed comments expressing their support for making spectrum in the TV bands available for unlicensed use. These parties generally submit that use of TV frequencies could improve signal coverage.[24]

Response:

We support these comments cited above by Intel and ITI. Even in congested areas, such as those of southeastern Michigan where there are many television broadcast stations, there are only approximately 25 – 6 Mhz channels occupied of the 60 channels licensed to operate. This leaves approximately 35 – 6 Mhz channels, or 210 Mhz of available TV spectrum that could be used today by the unlicensed Wireless industry to provide Broadband wireless services to their communities. Operation of wireless free-space services in the TV spectrum would solve radio frequency propagation coverage issues that exist at 2.45 GHz, 3.2 GHz, 5.3 & 5.8 GHz, and even at 900 Mhz.

11. Broadcasters, however, express concern that allowing unlicensed operation in the TV bands would pose a risk of interference to over-the-air television service and could adversely affect the DTV transition. The Association for Maximum Service Television, Inc., the National Association of Broadcasters and the Association of Public Television Stations (MSTV/NAB/APTS), in joint comments, state that technologies that allow unlicensed devices to detect spectrum availability and change frequencies are still in development and have not been tested.[25] They state that unlicensed operation in the TV bands would be problematic during the DTV transition because the television bands will be in a crowded, fluid and fragile state during that period, and unlicensed devices could cause significant disruption to DTV service.[26] MSTV/NAB/APTS further state that there is very little unused spectrum in the broadcast TV bands, and the crowding in these bands will intensify after the transition because all stations, including Class A, low power TV, TV translator and TV booster stations must be squeezed into

[22] *See* CEA comments at 7.

[23] *See* ITI comments at 4.

[24] *See,* for example, Cliff LeBoeuf comments at 1, C. Crowley comments at 1, David Blood comments at 1, AMA Techtel Communications comments at 2, John Hokenson comments at 1, Air Networking comments at 1, Redline Communications at 5-6, Kevin Rice comments at 1, Lakeland Communication, Inc. comments at 1-2, Old Colorado City Communications at 6, Mutual Data Services, Inc. comments at 1, New Gen Wireless, Inc. comments at 1, Big Tube Wireless, LLC comments at 1, Keith Schmidt comments at 1, Chase 3000 comments at 2, Jason Hunt comments at 1, R.W. Shepardson comments at 1, David Lindley comments at 1, Eje Gustafsson comments at 1, Mark Worstall comments at 1, Netrepid comments at 1, Mother Lode Internet comments at 1, REC Networks comments at 1, Alvarion, Inc. comments at 1, Roy Preston comments at 1, David Robertson comments at 1, Kerry Penland comments at 1, Marlon K. Schafer comments at 1, and Scott Scriven comments at 1.

[25] *See* MSTV/NAB/APTS comments at 2-4.

[26] *Id.* at 8, 11.

channels 2-51 along with low power auxiliary devices and wireless medical telemetry equipment.[27] Cox Broadcasting believes that the Commission should not introduce unlicensed devices into the broadcast spectrum until the DTV transition ends in order to avoid causing even more uncertainty for broadcasters' digital plans.[28]

Response:

"Broadcasters, however, express concern that allowing unlicensed operation in the TV bands would pose a risk of interference to over-the-air television service and could adversely affect the DTV transition," **By allowing unlicensed operations in unoccupied TV spectrum, under the rules of Part 15 now imposed upon unlicensed devices, the risk posed is reduced to reasonable and manageable levels. The assertion that this operation of unlicensed operation "could" adversely affect the DTV transition is hollow. If anything it will encourage the existing broadcasters to accelerate their transition. Comments by monopolistic public carriers are anachronistic and self-serving and do not take into consideration the best interests of the public at large. Furthermore, proposed limitations on output power and advances in technology shall make possible interference a remote and isolated issue.**

12. Other parties express concern about possible interference from unlicensed devices to licensed non-broadcast services that operate on TV channels. Parties representing PLMRS/CMRS interests do not believe that unlicensed devices should be permitted to operate on TV channels 14-20, which are used by the PLMRS/CMRS in certain parts of the country, or on TV channels above 51, which have been reallocated for other services. In addition, manufacturers of wireless microphones that operate on VHF and UHF TV channels are concerned about possible interference from unlicensed devices.[29]

Response:

While the interests of PLMRS/CMRS and the wireless microphone manufacturers are important, the use of cognitive radios that will make possible the detection of interfering carriers and enable the adjustment of output levels, and possibly even "frequency shifts" to non-interfering frequencies; these capabilities reduce the impact of arguments impact against use on the issues at hand. While these frequencies are well known and do not employ the latest spread spectrum technologies, the unlicensed WISP industry must employ the most sophisticated devices to be able to operate in an existing hostile radio frequency interference environment. Cognitive radio is yet another technology which may need to be initiated by the wireless industry to overcome exactly these arguments.

To reiterate a point made above, notwithstanding the afore going arguments, if "Cognitive Radio" becomes "the solution" for operation of unlicensed devices in the TV Spectrum; it

[27] *Id.* at 15.

[28] *See* Cox comments at 4.

[29] *See* Shure comments at 9 and Shure reply comments at 2-6.

should not limit the efforts of the FCC and industry that are currently engaged in opening new spectrum for use by Unlicensed devices.

13. As we observed in the *Notice*, during and after the DTV transition there will typically be a number of TV channels in a given geographic area that are not being used by full service analog or digital TV stations, because such stations will not be able to operate without causing interference to co-channel or adjacent channel stations. For example, the rules for digital TV allotments specify minimum separations between co-channel stations ranging from 196.3 to 273.6 kilometers, and separations between adjacent channel stations that are not co-located or in close proximity of 110 kilometers.[30] These minimum required separations between TV stations are based on the assumption that stations operate at maximum power. However, a transmitter operating on a vacant TV channel at a power level much lower than that of a TV station would not need as great a separation from co-channel and adjacent channel TV stations to avoid causing interference. Many DTV stations were established in the initial DTV table at lower power levels and closer distance separations to other stations. Low power TV, TV translators and Class A TV stations also operate at lower power levels than full service stations and thus fit into locations where full service stations could not operate. The unlicensed transmitters we are considering now would operate with less power than low power TV, TV translator and Class A TV stations. Thus, it would seem feasible for low power unlicensed transmitters to operate on vacant channels in locations that could not be used by TV stations due to interference concerns. In addition, in some areas not all of the channels that could be used by TV stations are being used, and those vacant channels could be also be used by unlicensed devices.

Response:

We fully support the statement. Furthermore, by the implementation of unlicensed operating rules that require voluntary compliance, unlicensed devices should be able to operate in the range of 10 – 20 watts EIRP, depending upon a determination of the available frequencies, distances to adjacent and co-channel carriers, and a technology such as cognitive radio that encourages identification and avoidance of interfering carriers.

14. In view of the interest expressed in response to the *Notice* by manufacturers and others supporting the use of unused TV spectrum for unlicensed operations and the growing consumer demand for unlicensed broadband devices, such as Wi-Fi and LAN applications, we believe it would be desirable and appropriate to allow relatively low power unlicensed broadband devices to operate in these areas where TV channels are not used for TV service, with appropriate safeguards. We agree with these parties that the propagation characteristics of the spectrum occupied by the TV service would allow the design and manufacture of new types of unlicensed wireless broadband devices that could serve applications that need a greater range of operation and coverage than that afforded by unlicensed devices operating in higher frequency regions of the spectrum. We further note that the six megahertz bandwidth of a vacant broadcast TV channel is generally wide enough to support broadband operation and that often multiple vacant channels may be available in an area to provide additional bandwidth. We also note that permitting unlicensed devices to operate on TV channels that are not being used in a particular area could allow more efficient use of this spectrum.

[30] These numbers are for separations between digital stations. *See* 47 C.F.R. § 73.623(d). The separations differ depending on the zone where the stations are located and whether the stations are in the VHF or UHF band.

Response:

We fully support item 14 above. And wholly concur with the comment regarding efficient spectral use.

15. While we understand the concerns of broadcasters and other existing authorized users of the TV bands about the possibility of new interference, we believe that with appropriate safeguards it would be possible to allow unlicensed operation in the TV bands without causing new harmful interference to television services, disrupting the DTV transition, or adversely affecting the other services that use this spectrum. In this regard, we disagree with broadcasters regarding the potential of technical solutions for ensuring that unlicensed devices only use vacant channel space. As discussed below, it appears that there are technical options now available that make it feasible for new types of unlicensed equipment to share spectrum in the TV bands without causing harmful interference to TV broadcast or other licensed services operating within these bands. Thus, we believe it is possible to operate unlicensed transmitters on vacant TV channels without causing harmful interference to any authorized services in the TV bands, provided that the unlicensed transmitters incorporate means to ensure that they operate only on vacant channels and that they comply with appropriate limits on power and operating frequency. We will, of course, carefully consider the feasibility of any technical plan for avoiding interference from unlicensed devices to existing authorized service to ensure that those services will be adequately protected in any decision we may make to allow unlicensed devices to operate in this spectrum. In this regard, we note that identification of harmful interference to television service may present some concerns that are different from other services. In particular, television viewers generally constitute the broad range of the population and therefore may be less familiar with the technical reasons for and sources of degradations of service quality than other radio service users who are more familiar with the technical aspects of radio operation. Further, we note that interference to DTV operations may result in abrupt loss of service due to the "cliff effect" of digital transmissions.[31] Thus, additional care may be needed here as contrasted to other situations where sharing among commercial entities is involved.

Response:

We completely support this comment. Adequate voluntary compliant rules for operating unlicensed devices in the TV spectrum and the use of technologies allowing interference analysis and frequency shifting away from interfering carriers will ensure that the "cliff or avalanche effect" will be avoided.

16. We request comment on our tentative conclusions regarding the interest in operation of unlicensed devices in the broadcast TV bands and the suitability of those bands for such operations. In the following sections, we set forth and request comment on proposals for requirements to ensure that unlicensed broadband devices operating in the TV bands would transmit on vacant spectrum and not interfere with authorized incumbent operations, including: analog and digital television, low power television, television translator, television booster, and Class A television stations (as well as future authorization of digital low power television, television translator and television booster stations being

[31] With digital operations, interference or inadequate signal typically results in abrupt loss of service rather the gradual degradation that occurs with analog operations. That is, with DTV, service goes from a perfect picture to no picture with very small changes in interference or signals levels, as the DTV minimum threshold for service is crossed.

considered in MB Docket No. 03-185);[32] broadcast auxiliary services such as wireless microphones; and PLMRS and CMRS backhaul operations.

Response:

Wireless Internet Service Providers (WISPs) are dedicated to the use of the unused TV spectrum for the non-interfering provision of network services in urban, suburban, and rural areas of the United States. As this spectrum is vacant and unused currently, it is wholly suitable for use by unlicensed devices.

B. Requirements for Unlicensed Use of the TV Bands

17. Because unlicensed broadband devices would share spectrum with broadcast TV and other licensed services, they would need to have capabilities to avoid causing harmful interference to licensed services in the TV band. Specifically, an unlicensed device would need the ability to determine whether a TV channel or frequency band is unused before it could transmit.[33] Additionally, an unlicensed device may need capabilities to avoid occupying a frequency band in the event a licensed user wishes to commence transmissions on a channel that was previously vacant. As pointed out by a number of parties with interest in TV broadcasting, this capability is especially important in light of the transition to DTV and the facts that many broadcasters may be required to change their current DTV channel and that new DTV stations may begin operation.[34]

Response:

The recent advances in software driven, or defined, radios allow these devices currently to determine the receive threshold of both transmit and receive radios on a given path and change the modulation scheme and decrease receiver threshold sensitivity to accommodate instantaneous dynamic path performance characteristics. That is, the radios modulators are software defined, or another way of stating this, the devices modulators are software modulators, not hardware or firmware constructed. Given this ability, it is only another step away to determine the level and type of interfering carrier, DTV for example, and change the output level and modulation scheme to accommodate another service. Additionally, a further step will allow these "cognitive", or smart, radios to review other frequencies for the same type of interfering carriers, as viewed from the perspective of the unlicensed device, and chose another frequency to transmit its information upon. While some of these abilities are present today in a limited number of products, auto detecting dynamic path performance variability's, and changing receiver sensitivity and shifting its modulation schemes to accommodate these changes in transmission path characteristics was no small feat. Radios with the additional features discussed shall be forthcoming.

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[32] *See Notice of Proposed Rule Making* in MB Docket No. 03-185, 18 FCC Rcd 18365 (2003).

[33] We note that the ability to make this determination is unrelated to the determination of whether a household is "served" or "unserved" for purposes of the Satellite Home Viewer Improvement Act. *See* 17 U.S.C. § 119(a)(2)(B) and (d)(10).

[34] Channel changes may be required to accommodate broadcasters with out-of-core DTV channels, i.e., channels not within TV channels 2-51.

18. As indicated above, the development of broadband unlicensed industry standards have enabled the introduction of a host of new unlicensed wireless broadband products. In general, these products can be divided into two distinct types of operations. The first type involves wireless portable computing devices, such as laptops and PDAs, wireless home and local area networks (LANs), and other short-range applications within a home or a business. These operations can be used to provide broadband wireless connectivity between a cable or DSL modem and in-home computing devices; broadband wireless home entertainment applications, such as video/home theater use; business applications such as wireless inventory control and wireless cash registers; and personal applications such as wireless headphones. The second type of operation involves the provision of broadband services to homes and businesses. Unlike the first type of operations that are generally very low power or used indoors or within a small localized area, this type of operation uses higher power, is primarily fixed and used outdoors, may cover a substantial geographic area, and may be part of a commercial service infrastructure. In this regard, WISPs are now using unlicensed devices to provide broadband service on a point-to-point basis over distances of several kilometers. These two types of operations may also be used together. For example, a WISP may provide broadband service to laptops and PDAs using a high gain receive antenna for reception from portable/personal devices.

Response:

While WISPs currently provide these services via spread spectrum, and proprietary modulation technologies in their transmission systems, both Point-to-Point (PtP) and Point-to-Multipoint (PMP), these systems are limited in range and do not penetrate even moderate arboreal foliage well. Thus, a WISPs ability to serve any user desiring its services in a given market is severely limited.

19. For the purpose of developing interference protection criteria, we propose to classify the unlicensed broadband devices to be used in the TV bands into these two general functional categories. The first category will consist of lower power "personal/portable" unlicensed devices, such as Wi-Fi like cards in laptop computers or wireless in-home LANs. The second category will consist of higher power "fixed/access" unlicensed devices that are generally operated from a fixed location and may be used to provide a commercial service such as wireless broadband internet access. We believe that both of these types of operations can be accommodated in the TV spectrum, provided appropriate measures are taken to ensure that operations are limited to unused TV channels. At the same time, we recognize that different requirements may be appropriate for ensuring interference protection to licensed operations from the two different types of devices, given the differences in the uses and the interference potential of these types of unlicensed broadband applications. That is, certain methods that are appropriate for limiting the interference potential of personal/portable devices would be less appropriate for fixed/access devices and vice versa. Therefore, as discussed below, we propose different interference avoidance requirements for these two different types of unlicensed broadband applications. In both cases, however, our goal is to make the technical requirements as simple and as reliable as possible. We believe that this approach will provide flexibility to permit a wide range of unlicensed broadband uses and applications and ensure that the most appropriate and effective mechanisms are in place to limit such unlicensed use to only unused TV channels.

Response:

Operating on unused TV Spectrum in a given geographic area does not present an insurmountable challenge. The assignments have been made, the uses are well understood, and non-interfering transmission levels can be calculated.

Interference avoidance from "personal/portable" devices may be achieved through the limitation of these unlicensed devices from these lower frequency TV Spectrum frequency areas. As these devices do not need to respond to the "fixed/Access" devices directly and only need to operate within relatively short distances, the home/office/enterprise, wireless LAN can be restricted to the non-TV spectrum, and to operate at reduced power levels that are presently used to operate these limited distance systems.

The "fixed/access" carrier systems can then be allowed to operate in a more dynamic environment that will contain the interfering carrier problems.

20. There are at least three methods that could be used to determine whether a portion of the TV band is unused at a specific time and/or location. First, the location of an unlicensed device could be determined by a professional installer or by using geo-location technology such as GPS incorporated within the device. Using either of these methods, it could then be determined from either an internal or external database whether the unlicensed device is located far enough outside the protected service contours of licensed stations to avoid causing harmful interference. A second method would be for an unlicensed device to receive information transmitted by an external source such as a broadcast station or another unlicensed transmitter indicating which channels are available at its geographic location. A third method would be to incorporate sensing capabilities in the unlicensed device to detect whether other transmitters are operating in an area. For example, a fixed unlicensed transmitter could be required to incorporate an antenna and a receiver capable of detecting signals down to a certain threshold level that would be used to determine if a particular TV channel is actually in use. Generally, such sensing would have to be much more sensitive than the receivers used in the licensed service. [35] If no signals were detected above the threshold, the device would be allowed to transmit. If signals are detected above the threshold on a particular channel, the unlicensed device would have to search for another channel. As the Commission has previously noted, there are techniques that can be used to increase the ability of a sensing receiver to reliably detect other signals in a band which rely on the fact that it is not necessary to decode the information in a signal to determine whether a signal is present.[36]

Response:

We support the three (3) conceptual methods defined in item 20 above and suggest that further research and engineering be conducted. A fourth (4th) method could also be employed. This method is similar to addressing, *"analog and digital television, low power television, television translator, television booster, and Class A television stations (as well as future authorization of digital low power television, television translator and television booster*

[35] Spectrum sensing has a disadvantage that is sometimes referred to as the "hidden node problem." In the case of unlicensed devices in the TV band, this problem could arise when there is signal blockage between the unlicensed device and a TV station, but no blockage between the TV station and a TV receiver and no blockage between the unlicensed device and the same TV receiver. In such a case, the sensing receiver in the unlicensed device may not detect the presence of the TV signal because it is blocked, and the unlicensed device may therefore commence transmissions on an occupied channel, thus causing interference at the TV receiver. *See ex parte* presentation by Shared Spectrum Company in ET Docket No. 02-380, on September 29, 2003.

[36] For example, sensing can be made more sensitive by using bandwidths much smaller than a 6 MHz TV channel and/or can look for specific features of the TV signal such as the visual and audio carriers. *See Notice of Proposed Rule Making and Order* in ET Docket No. 03-108, 18 FCC Rcd 26859 (2003).

stations being considered in MB Docket No. 03-185);" **and would be assigned a digital signature, each different service assigned a different signature, that would be recognizable to the unlicensed devices of the WISPs. The recognition of these digital signatures would signal the unlicensed cognitive radio to (1) transmit normally, as the interfering carrier level would be within tolerable levels, (2) lower the output level and receiver sensitivity of a receive path segment; or (3) through its spread spectrum capability, switch to an alternative TV spectrum frequency that has acceptable operating properties. The "hidden node problem" requires a unique solution to this proposal.**

21. *Unlicensed Personal/Portable Operations*. Interference was the primary concern raised by parties opposed to unlicensed operations in the TV bands. These parties raise valid concerns that given the potential ubiquitous and uncontrolled deployment of unlicensed devices, any requirements on these devices must ensure that the devices only transmit on unused TV channels. To ensure that this is the case, we are proposing to allow personal/portable unlicensed broadband devices to transmit only after they receive a "control" signal that positively identifies which TV channels are vacant and therefore available for use. Without reception of this "control" signal, no transmissions would be permitted. This would provide positive assurance that these devices would operate only on unused TV channels. We propose to permit the transmission of control signal data by a number of sources. In particular, we propose that the control signal could be a data stream from a digital TV station, information transmitted in the vertical blanking interval (VBI) of an analog TV station, subcarrier data from an FM radio station, data transmitted by a licensed wireless provider, or channel availability data from a fixed/access unlicensed device. We propose that the transmission of this information would be on a voluntary basis and that parties could receive compensation for transmitting this information. Under the approach we are proposing, a TV channel would be considered vacant only if no portion of the service area of an authorized station assigned to use that channel was within the service area of the station transmitting the control signal. For example, if the information is transmitted by a DTV station, the identified vacant channels must not be used for the provision of television or other licensed services anywhere within the noise-limited service contour of that DTV station. We also seek comment on how often the control signal information should be transmitted and updated to take into account changes in TV station operations that arise due to the transition to DTV and the commencement of new stations. We tentatively believe that control signal information should be at a minimum current on a daily basis. Our proposals for the technical requirements for determining when a channel is unused are set forth below.

Response:

We support the proposal outlined in 21 above, or a similar solution that identifies the described service. Notwithstanding, this places undue restraint upon the unlicensed operators without considering the effects of an interfering carrier from the transmissions of a TV spectrum carrier beyond their service area.

The proposal in 21 above is similar to the proposal described in the response to item 20 above, however, this does not completely solve the "hidden node problem" for TV receivers, or unlicensed users, that are just beyond the edge of the "TV service area" and yet still receive an acceptable signal from the desired service provider, either TV or WISP service.

22. Given the portable and potentially ubiquitous nature of these devices and the importance of protecting television service, we believe that, at least initially, unlicensed personal/portable broadband

devices that operate in the TV bands should be subject to certain additional requirements. In particular, we propose to limit the maximum power output of these devices to 100 milliwatts (mW) and to require that such devices have a permanently attached integral antenna with a maximum permissible gain of 6 dBi.[37] We believe that these power and antenna provisions will provide sufficient communications capabilities to allow personal/portable broadband devices to serve a wide range of broadband applications, such as home networks, LANs and broadband connectivity, while at the same time limiting the potential for interference and RF safety concerns. We seek comment on whether these devices should be subject to routine evaluation for RF exposure.[38] We also seek comment on whether we should allow higher power operation and what safeguards would be needed to protect current and future licensees in the TV bands. We further propose to require that such devices automatically and periodically transmit a unique identification signal. We seek comment on what information should be required to be transmitted and how often it should be repeated for easy identification of the unlicensed device. For example, should we require the device to transmit the name of its manufacturer, its FCC identifier, and its serial number? What time interval would be appropriate for periodic transmission of the identifying information? We believe that taken together these proposed requirements address the interference concerns raised by commenting parties. In particular, we believe that this plan will appropriately manage the potential for harmful interference to television and other licensed services from unlicensed personal/portable devices and, in the unlikely event that such interference were to occur, provide a positive means to identify its source so that it can be eliminated.

Response

We support the concept of limiting the output power of PCMCIA cards, PC Cards, operating in the TV Spectrum to 100 mW and a maximum permissible antenna gain of 6 dBi for an integral antenna. However, we do not support any routine or periodic evaluation or testing of these devices for RF exposure. Certainly not if that evaluation or testing is to be conducted by the TV industry; "fox and hen house syndrome." The use of a higher power antenna should be allowed when that antenna is being used to connect to a WISP and is not aimed at the TV transmit facility. We strongly oppose the requirement that any such wireless devices be required to "*automatically and periodically transmit a unique identification signal."*** **This requirement amounts to an invasion of personal privacy and will in no way contribute to the reduction of interfering signals regarding a television transmitter or receiver. Furthermore, all these assumptions require that the personal/portable unlicensed device is transmitting into the main lobe of the receivers antenna.**

Additionally, there is some assumption that this low level unlicensed device may in some way modulate the carrier signal from the TV transmitter. There is no evidence in the scientific or technical literature that any signal of this magnitude is capable of performing this intermodulation feat.

Secondly, higher power operation for these personal/portable unlicensed devices should be allowed. A maximum power output of 200 mW is recommended with a 6 dBi antenna.

[37] The same characteristics would apply to both transmit and receive antenna(s).

[38] *See* 47 C.F.R. §§ 1.1307(b) and 2.1093.

Safeguards for the current and future licensees in the TV bands will already be in place by disallowing the use of these unlicensed systems on the licensed channel within their service area.

Third, We stipulate that no information be transmitted for easy identification of the unlicensed device.

Fourth, *"For example, should we require the device to transmit the name of its manufacturer, its FCC identifier, and its serial number?"* **No, this requirement should be abandoned.**

Fifth, *"What time interval would be appropriate for periodic transmission of the identifying information?"* **This proposal should be abandoned. The restriction that no unlicensed devices be allowed to transmit, receive, or operate on TV channel spectrum within the service area of that TV broadcast signal will preclude any Wireless services from being offered within the service area of a TV broadcast service. That shall be adequate. Furthermore, no WISP would take the chance of offering such a potentially poorly performing service to their subscribers in the service area, the power of the TV broadcast transmitter would preclude the successful operation of a service. Especially when the WISP could move two (2) channels away and have clear channel use of a non-adjacent channel frequency. While the broadcasters may "demand" these guarantees, the unlicensed radio service industry is only asking the Commission for an opportunity to provided a sorely need service not presently available the public on a universal basis.**

23. These proposals could benefit broadcasters in addition to manufacturers and users of these unlicensed personal/portable broadband devices. We anticipate that under this approach, manufacturers could have increased incentive to incorporate a DTV receiver into a portable computing device or laptop computer to obtain "control" signal information on channel availability from one or more local broadcast stations.[39] This same receiver could also allow the laptop or portable computing device to display a station's DTV program service and could provide broadcasters the opportunity to offer new services to users of these devices. For example, broadcasters could offer new sports, equity market and other information services to these devices using the data capabilities of digital television. These receivers could also contribute to increasing the production and performance of DTV receivers and thereby promote the development of the economies of scale that are needed to allow the marketing of low cost DTV receivers. Further, the widespread availability of DTV receivers in portable/laptop computers could increase consumer demand for over-the-air DTV services. The transmitters in these devices in conjunction with fixed/access unlicensed broadband devices as proposed below, could also provide a return path for interactive transmissions by TV stations or provide internet connectivity. Further, we note that some broadcasters are investigating the possible use of distributed transmission technology to improve DTV coverage and reception. The presence of remote facilities and the improved signal strength offered by this technology could offer some additional synergies for using vacant TV channels for a return path and internet connectivity.

[39] To the extent that DTV reception capability encompassing either a demodulator and associated transport stream processor or a peripheral TSP product as defined in §73.9000(j) of the Commission's rules, were to be incorporated into such devices, they would be required to comply with the Commission's DTV redistribution control rules. See 47 C.F.R. subpart M; see also Digital Broadcast Content Protection, 18 FCC Rcd 23, 550 (2003).

Response:

The broadcasters would do well to attempt to provide a marketable service over their licensed TV spectrum. A challenge that has increased in magnitude over the past few years.

24. We seek comment on these proposals. In particular, we seek specific comment on what is the most efficient and effective method for providing control signals to unlicensed devices. In this regard, we ask whether broadcasters would voluntarily engage in agreements with unlicensed device manufacturers or service providers to transmit this information. We note agreements with unlicensed device manufacturers to carry channel availability data could provide broadcasters a new source of revenue. For example, we understand that many FM radio broadcasters have agreed to transmit information to support devices using Microsoft's Smart Personal Object Technology ("SPOT").[40] While we believe that voluntary approaches are the most desirable means for providing control channel information, we also request comment on whether we should require TV stations to transmit this information and how frequently such information should be transmitted. We further request comment on whether we should designate specific entities that would be responsible for determining the unused channels in a station's service area. For example, this function could be performed by frequency coordinators, engineering consulting firms, or broadcast trade associations. We also seek comment on the frequency with which these entities update their information on allotments and vacancies and whether we should provide guidelines in that regard. Additionally, we seek comment on whether constraints are needed on stations retransmitting controls signals to ensure that the control signals are not transmitted or received beyond the originating station's service area. For example, translator stations generally retransmit the entire signal of a primary TV station. How should we should we ensure that translators do not inappropriately retransmit the control signals of their primary TV stations beyond the coverage area of those stations? We also request comment on the desirability and practicality of using other approaches for preventing harmful interference to TV services from personal/portable unlicensed devices in the TV bands. In particular, parties favoring such approaches should describe how such techniques would ensure that unlicensed devices only operate on vacant spectrum and not cause harmful interference to licensed services. We also request comment on whether additional requirements would be appropriate for personal/portable operations. For example, should we require that all personal/portable devices be registered with an industry-accepted entity, such as a frequency coordinator, that maintains a registration database of all models of personal/portable transmitters along with their operating frequencies? This registration data base could include the unique identification of the personal/portable device. We also request comment and suggestions on the appropriate entity that we should select to maintain such a registration database.

These requested comments have been addressed above. We know we don't like the idea of the Fed exercising "control" over the available spectrum, however, we do want them to grant use of this spectrum for use by unlicensed devices.

25. *Fixed/Access Unlicensed Devices*. Fixed/access types of devices present different operational and interference considerations. In general, we anticipate that these devices would be used by WISPs and others as base stations to provide internet access and other broadband data services to homes and businesses, including to personal/portable services. We propose to allow fixed/access devices to operate under the same technical provisions as digital transmission systems that operate under Section

[40] *See* www.spotstop.com for additional information.

15.247 of the rules.[41] This would permit fixed/access devices to operate with a transmitter output power of up to one watt and to employ higher gain directional antennas, with requirements for transmitter output reductions for antennas with gains above 6 dBi. We believe that these power levels are sufficient to be useful for WISPs and other wireless networking applications and will ensure that these devices can successfully share the TV spectrum. We also believe that these power and antenna provisions will limit the potential for interference and RF safety concerns. We seek comment on whether these devices should be subject to routine evaluation for RF exposure.[42] We further propose to require that such devices automatically and periodically transmit a unique identification so that any harmful interference situation, should it occur, can be quickly identified and remedied. We request comment on what information should be required to be transmitted, in what format, and how often it should be repeated for easy identification of the unlicensed device. For example, should we require unlicensed fixed/access devices to transmit location information, name of manufacturer, FCC identifier, and serial number? What time interval would be appropriate for periodic transmission of the identification information?

Response:

We support the commissions finding here in part. We strongly recommend that the commission allow the use of higher gain directional antennas and very narrow beam antennas for point-to-point (PtP) transmissions. The commission should be applauded for it efforts on behalf of the unlicensed Wireless industry in making the unused TV spectrum available to the industry. The inclusion of the authority to use higher gain, narrow beam antennas, with the responsibility for non-interference falling on the shoulders of the most recent operator, and the voluntary non-interference responsibility falling on all users, has served the nation and all communications users excellently in the past. The use of highly directional, narrow beam, high gain antennas will greatly reduce the threat of interference and improve the coverage, performance and reliability of the unlicensed industry. As in all telecommunications areas "back-haul" and cell interconnection are of critical importance to the provision of reliable, efficient information, and data services. By increasing the gain of narrow beam antennas for point to point and backhaul service to 24 dBi, the Commission will place the unlicensed industry in a position to provide the reliability and performance required in today's highly competitive marketplace.

We see no reason for routine evaluation for RF exposure, unless it is extended to all radio devices operating at all frequencies, within the regulatory control of the Commission. RF exposure to a 36 dB transmit signal is of no consequence when compared to the 90 dB signal level of many broadcast radio services.

The suggested requirement – *"We further propose to require that such devices automatically and periodically transmit a unique identification so that any harmful interference situation, should it occur, can be quickly identified and remedied. We request comment on what information should be required to be transmitted, in what format, and how often it should be repeated for easy identification of the unlicensed device. For example, should we require unlicensed fixed/access devices to transmit location information, name of manufacturer, FCC identifier, and serial number? What time interval would be*

[41] *See* 47 C.F.R. § 15.247(b)(3).

[42] *See* 47 C.F.R. §§ 1.1307(b) and 2.1091.

appropriate for periodic transmission of the identification information?" **is counterproductive and wasteful of scarce regulatory resources. The Commission has been courageous and farsighted in moving to open the unused TV spectrum for use by the unlicensed industry. Their intuitive economic impact in the near and long term will influence the short-term recovery and encourage the long-term economic development of under developed rural areas.**

Voluntary compliance with FCC Rules has proven to work well in the past and has encouraged cooperation and innovation in the communications industry. This free market approach has served us well. We oppose any changes to the rules that would stifle an open and cooperative market place.

As stated above, with the present rules in place no WISP is going to operate within a licensed TV channel, nor will they intentionally interfere with an operating TV broadcast system. The broadcast industries hand-wringing to the contrary, the WISP industry operates at low power, and is only seeking an opportunity to better serve their existing customer base. WE oppose the transmitting of "unique identifiers" of any type at any interval, for any purpose.

The unlicensed WISP industry shall obey the rules, and operate solely in "unused" channels at the power levels dictated by the Commission. There is no need for extraordinary measures to accommodate a recalcitrant broadcast industry.

26. To ensure that fixed/access devices operate only on unused TV channels, we propose to require that such devices incorporate a method for determining geographic location with a minimum accuracy of 10 meters. To meet this requirement, for example, the device could incorporate a GPS receiver to determine its geographic coordinates. Using this location information, local broadcast station data and the protection requirements described below, channel availability for the unlicensed device can be determined. We therefore propose to require that the fixed/access unlicensed transmitter have the capability to access such a database and appropriate computational software to determine which TV channels are available for unlicensed use based on its location. The equipment would also be required to have the capability to limit its transmissions to only those channels that are identified as unused through this process.[43] As an alternative, we propose to require that the unlicensed device be professionally installed by a party that would determine the device's geographic location and the available unused channels at that location. In this case, the installer could provide the device's coordinates to a frequency coordinator, industry association, local broadcast group or other party that maintains an appropriate and current data base to determine which TV channels are unused at the device's location. The installing party would then configure the device to operate only on unused channels. We seek comment on the

[43] For example, under one possible implementation of this approach, the "control" signal concept could be combined with the geo-location capability of the fixed/access device to provide an automated frequency coordination process for fixed/access devices. Under this approach, a broadcaster using appropriate computational software could transmit control information that described channel availability in various portions of its service area. In particular, a TV station could transmit channel availability data on a sector or grid basis to fixed/access devices.

qualifications an individual must possess in order to be classified as a professional installer.[44] We recognize that industry organizations such as the National Association of Radio Telecommunications Engineers (NARTE) and The Part-15 Organization have developed Professional Installer Certification programs designed to ensure that installers are able to set up unlicensed links in a manner to minimize the possibility of creating harmful interference to other users of the spectrum.[45] Should the Commission consider completion of industry-based certification programs such as these to be sufficient training to be recognized as a professional installer? What criteria should the Commission place on any such programs that it deems acceptable? As a second alternative, we seek comment on whether the control signal approach would also be appropriate for fixed/access devices. Under any of these approaches, we would require that the unlicensed device or its operator periodically access the channel availability database and software to ensure that the channels on which the device operates remain unused. We anticipate that this database and software could be made available by unlicensed equipment vendors, broadcast engineering firms or other third-party providers. We request comment on how often an unlicensed device or operator must access the channel availability database and update or reprogram the device's usable channel list.

Response:

The coverage areas for broadcast TV are presently well defined. We would accept reporting the coordinates and proposed spectrum usage to a frequency coordinator, such as:

Microwave Frequency Coordinators

The following list of microwave coordinators is provided for information purposes only, and may not constitute a complete list of available frequency coordinators. The Federal Communications Commission does not license or endorse any microwave frequency coordinators. Additional information regarding microwave frequency coordination is also available from the National Spectrum Managers Association (NSMA). NSMA is a voluntary, not-for-profit organization providing an industry forum for microwave frequency coordinators.

ACD Telecom, Inc.
367 Eagle Creek Circle
Lake Mary, FL 32746
Phone: (407) 302-4223
Fax: (707) 924-1216
Email: acdtelecom@cfl.rr.com

Beyran Telecom (BEYTEL)
9 Ridge Heights Court
Gaithersburg, MD 20879
Phone: (301) 330-2860
Fax: (301) 330-8841
E-Mail: ahmad@beyran.com

[44] We note that the definition of who qualifies as a "professional" installer is also being considered in ET Docket No. 03-201, 18 FCC Rcd. 18910 (2003) and ET Docket No 04-151, FCC 04-100 (rel. April 23, 2004)..

[45] *See*, *e.g.*, www.narte.org and www.part-15.org.

Black & Associates
2052 Bridgegate Court
Westlake Village, CA 91361
Phone: (805) 495-7619

Comsearch
19700 Janelia Farm Boulevard
Ashburn, VA 20147
Phone: (703) 726-5500
Fax: (703) 726-5595

Consolidated Spectrum Services
22 Merrill Drive
Atkinson, NH 03811
Phone: (603) 362-5977
Email: howard@fcc1.biz

ITA (Industrial Telecommunications Association)
8484 Westpark Drive
McLean, VA 22102
Phone: (703) 528-5115

Micronet Communications, Inc.
720 F Avenue, Suite 100
Plano, TX 75074
Phone: (972) 422-7200

Microwave Planning, Inc.
P.O. Box 741115
Dallas, TX 75374-1115
Phone: (214) 437-4667

Multicomm Sciences International, Inc.
266 West Main Street
Denville, NJ 07834
Phone: (973) 627-7400
Fax: (973) 625-1002
Email: mail@MulticommSciences.com

NuComm Inc.
104 Elden Street, Suite 10
Herndon, VA 20170-4809
Phone: (703) 925-0820
Fax: (703) 925-0801

Pinnacle Telecom Group

14 Ridgedale Avenue - Suite 262
Cedar Knolls, NJ 07927
Phone: (973) 451-1630 - x102

Radio Dynamics Corporation
P.O. Box 34906
Bethesda, MD 20827
Phone: (301) 493-5171
Fax: (301) 493-5162

UTC Spectrum Services
200 North Glebe Rd Ste 1000
Arlington, VA 22203
Phone: 703-558-2213
Fax: 703-558-0523

To provide:

Interference Analysis – Including a detailed frequency search within a predetermined set of unused TV spectrum channels to identify possible interference for a proposed unlicensed system to operate in that predetermined area based on customer and FCC provided parameters. The study should include an analysis of all combinations of frequencies and polarizations within a predetermined set of unused TV spectrum channels. Alternate parameters such as antenna or equipment changes may also be studied to maximize frequency availability at the direction of the proposed unlicensed user.

Frequency Coordination – Should Include frequency coordination for the proposed service area with existing and prior-coordinated TV Spectrum used in that area.

27. We request comment on this approach, recognizing in particular the changes that will occur during the DTV transition. We also seek comment on whether we should allow fixed/access devices to operate with higher power than proposed above and, if so, what safeguards would be needed to protect current licensees in the TV bands. We note that we recently proposed to allow certain unlicensed devices to operate with higher power in rural or other areas with limited spectrum use.[46] We also seek comment on whether we should require devices to use transmit power control (TPC) and operate with the minimum power necessary to achieve reliable communication to reduce the possibility of interference to licensed services and to enable better spectrum sharing between unlicensed devices.

Response:

Under no circumstances do We support the involvement of any broadcast industry association, local broadcast group, or other broadcast entity making decisions regarding the availability of unused TV Spectrum or the possible interference of an unlicensed user on TV Spectrum that should be available based upon current FCC coverage's for those channels. If the FCC has determined that specific TV Spectrum is available in a given

[46] *See Notice of Proposed Rule Making and Order* in ET Docket No. 03-108, 18 FCC Rcd 26859 (2003).

area, then the unlicensed community should be able to use that spectrum, with the appropriate engineering and system design performed to not interfere with existing broadcast stations within their operating areas.

Allowing fixed/access devices to operate with higher power than proposed above should be allowed where it can be shown, through an independent FCC approved Frequency Coordinating organization, such as those listed above, that operating at those higher power levels will not produce interference to existing broadcast stations in the proposed area for unlicensed operation.

28. We also request comment on whether additional requirements would be appropriate for fixed/access operations. For example, should we require that all fixed/access devices also be registered with an industry-accepted entity, such as a frequency coordinator, that maintains a registration database of all fixed/access transmitters along with their operating frequencies? This registration data base would include the unique identification of the fixed/access device, its geographic coordinates, and the channels available for use at that location. We also request comment and suggestions on the appropriate entity that we should select to maintain such a registration database. In addition, we request comment on whether we should permit fixed/access devices to use a spectrum sensing approach, as an alternative to the geo-location approach described above. We request comment on what would be the appropriate signal levels that an unlicensed device would need to be capable of detecting to ensure that no harmful interference is caused to licensed operations, and the current availability of suitable detection measures and devices. In addition, when making a determination as to an appropriate signal level, it would also be necessary to specify other parameters of the detection methodology to the extent these could not be incorporated in a signal level measurement, including, for example, the length, location, and frequency of the detection measurement.[47] In particular, we request parties to address how such an approach would consider the so-called "hidden node" problem where the unlicensed transmitting device may be shielded from the TV transmitter but have a direct path to a nearby TV receiver.

Response:

We support minimal additional requirements such as, all fixed/access devices be registered with an industry-accepted entity, such as the frequency coordinators listed above, that maintains a registration database of all fixed/access transmitters along with their operating frequencies and a unique identification of the fixed/access device, its geographic coordinates, and the channels available for use at that location.

If TV Spectrum has been determined to be available within a specific area and any unlicensed transmitter is used within that area using good engineering practices, then there shall be no interfering carriers for the broadcast industry to be concerned about. Furthermore, if there occur any instances of claimed interference, it shall be incumbent upon both the accusing and accused parties to ameliorate this interference on a voluntary basis. It shall not be incumbent upon an accused unlicensed carrier to mitigate claimed interference to a TV broadcaster based upon an unsubstantiated claim.

[47] Television viewers obtaining service over-the-air, for example, are typically assumed to have an antenna 30 feet above ground level and signal levels are presumed to vary over time by specified amounts. *See* 47 C.F.R. § 73.686.

C. Protection of Broadcast Television Service

29. In this section, we propose to define the technical criteria for determining when a TV channel can be considered vacant for the purpose of allowing operation of an unlicensed device on that channel. Analog and digital full service TV stations and Class A TV, low power TV, TV translator and TV booster stations are generally protected from interference within defined signal contours. The signal level defining a television station's protected contour varies depending on the type of station, *e.g.*, analog or digital TV, and the band in which a TV station operates.[48] Different protected contour values are specified for both analog and digital stations that operate in the low VHF band (channels 2-6), the high VHF band (channels 7-13) and the UHF band (channels 14-69), as follows:

Type of station	Protected contour		
	Channel	Contour (dBu)	Propagation curve
Analog TV	Low VHF (2-6)	47	F(50,50)
	High VHF (7-13)	56	F(50,50)
	UHF (14-69)	64	F(50,50)
Analog Class A, LPTV, translator and booster	Low VHF (2-6)	62	F(50,50)
	High VHF (7-13)	68	F(50,50)
	UHF (14-69)	74	F(50,50)
Digital TV	Low VHF (2-6)	28	F(50,90)
	High VHF (7-13)	36	F(50,90)
	UHF (14-51)	41	F(50,90)
Digital Class A	Low VHF (2-6)	43	F(50,90)
	High VHF (7-13)	48	F(50,90)
	UHF (14-51)	51	F(50,90)

We propose to use these service area criteria to define the areas that unlicensed devices must protect from harmful interference. All unlicensed operations would be required to protect TV service within the contours defined by these criteria.

Response:

We support these criteria that will define the operational contours for TV Service Spectrum and the non-interference requirements for the operation of unlicensed devices in TV Spectrum, if and only if These same criterion are required for Analog and digital full service TV stations and Class A TV, low power TV, TV translator and TV booster stations to prove any complaints regarding harmful interference from the operation of any unlicensed device.

30. Whether or not interference occurs depends on the desired-to-undesired (D/U) signal ratio needed for acceptable service. This D/U ratio will vary depending on the type of station, the frequency band and the nature of the undesired signal. In considering digital broadband unlicensed

[48] The protected contours are defined by 47 C.F.R. § 73.683(a) for analog TV stations, 47 C.F.R. §§ 73.6010(a) for Class A TV stations, 47 C.F.R. § 74.707(a)(1) for low power TV, translator and booster stations, 47 C.F.R. § 73.622(e) for digital TV stations, and 47 C.F.R. § 73.6010(d) for digital Class A stations.

operations in the television band, we note that such operations will be at very low power compared to television operations. We also believe that the signals from such unlicensed devices can be expected to appear "noise-like" and that the carrier-related interference mechanisms that can affect analog television would not occur. We therefore believe that the requirements needed to protect television service from digital unlicensed devices should be limited to co- and adjacent channel operations only for fixed/access operations and co-channel operations only for personal/portable operations. Given the expected noise-like character of signals from unlicensed devices, we are proposing to use the same protection criteria that are currently specified in the rules for digital television.[49] We request comment on this approach and on whether we need to proscribe a modulation requirement for such unlicensed devices to ensure that their transmissions appear noise-like. With regard to personal/portable operations, we believe at this time that the potential for harmful interference to adjacent channel television operations is sufficiently low that we do not need to impose adjacent channel restrictions on these devices. We note that even in the "worst case" situation at the edge of a television station's service area, *i.e.*, where the TV station's signal is the lowest, the interference potential from an adjacent channel personal/portable device would be minimal and, in practice, would be mitigated by the effects of ambient noise, shielding from buildings, walls, ground clutter, etc. We therefore are proposing to use the following criteria to ensure that unlicensed devices do not cause harmful interference to TV service:

Type of station	Protection ratios		
	Channel separation	D/U ratio (dB)	Propagation curve
Analog TV, Class A, LPTV, translator and booster	Co-channel	34	F(50,10)
	Upper adjacent	-17	F(50,50)
	Lower adjacent	-14	F(50,50)
Digital TV and Class A	Co-channel	23	F(50,10)
	Upper adjacent	-26	F(50,50)
	Lower adjacent	-28	F(50,50)

Response:

We do not support a proscribed modulation requirement for such unlicensed devices to ensure that their transmissions appear noise-like. Spread-Spectrum modulation schemes, as are most commonly used by WISP operators in unlicensed frequency spectrum, are designed to appear "Noise-like" and do not require proscription. Further, the low-level power restrictions for all unlicensed operation, spread-spectrum or proprietary modulation schemes, preclude the probability that these devices will create carrier-related interference that will affect analog or digital television.

31. We propose to require that these service and protection criteria be used in conjunction with appropriate computational software, including use of the Commission's propagation curves, and a television station engineering database to develop the control signal information on available channels for unlicensed personal/portable devices and for coordination and deployment of unlicensed fixed/access devices. All unlicensed operations in the TV bands would be subject to the general requirements of Part 15 for not causing harmful interference and would be required to ensure that the D/U ratios for acceptable

[49] *See* 47 C.F.R. § 73.623(c). The rules also specify the use of different propagation curves, *e.g.*, F(50,10) or F(50,50) depending on whether the undesired signal is a co- or adjacent channel. *See* 47 C.F.R. §§ 74.705(c), 74.707(c), 74.706(c) and 74.708(d)(ii).

television service in the above Table are always maintained. We also seek comment on whether there are any special considerations for cases where consumers use indoor DTV antennas. As indicated above, fixed/access unlicensed devices would be subject to the co- and adjacent channel D/U criteria while personal/portable devices would be subject only to the co-channel criteria. The adjacent channel D/U criteria would not apply to fixed/access devices between channels 4 and 5, channels 6 and 7, and channels 13 and 14 because of the frequency separations that exist between those channels.[50] That is, those channels are not actually on adjacent frequencies. For adjacent channel operations within the protected service contour, we propose to require that calculation of desired signal levels be based on FCC F(90,90) curves or the protected contour field strength value, whichever is higher. For unlicensed operation outside the protected contour of a television station, calculations of television (desired) signal levels would be based on the FCC F(50,50) curves. Calculations of unlicensed (undesired) signal levels would be based on the FCC F(50,50) curves or other appropriate models. We believe this approach should provide additional protection to television viewers within the protected contour of an adjacent channel station.[51]

Response:

We support this interference criterion and this approach.

32. In addition, we propose to not allow unlicensed devices to operate within the protected contour of any co-channel TV operation. This proposal along with the minimum D/U requirements would mean that such devices would have to be located at least some minimum distance outside the protected signal contours of co-channel television stations. This minimum distance would be determined using the values in above Table and would depend on the maximum power and antenna characteristics of the unlicensed device, the signal strength of the licensed station's protected service contour, the desired-to-undesired (D/U) signal ratio permitted at the licensed station's protected service contour, and the method used to calculate the signal contours of the unlicensed device. We seek comment on these proposals, including whether the proposed protection criteria are appropriate.

Response:

[50] The frequency separation between channels 4 and 5 is 4 MHz, the frequency separation between channels 6 and 7 is 86 MHz, and the frequency separation between channels 13 and 14 is 254 MHz.

[51] Under this approach, the computational software would calculate field strengths along a line determined by the locations of the TV transmitter and the unlicensed device. The field strength of the TV station (D) would be calculated using FCC curves and the licensed technical parameters of the station, *i.e.*, power, antenna height and antenna characteristics. The field strength of the unlicensed device (U) would be computed using the appropriate maximum power of the device and an assumed antenna height of 2 meters for portable/personal devices and 10 meters or the actual installed antenna height above ground, whichever is greater. Field strengths within 10 meters of the unlicensed device may be ignored since it could be assumed that this region would be under the unlicensed operator's control. At all points on the line segment from the TV transmitter to the edge of the TV station's protected contour, the D/U ratio would be calculated and compared to the minimum D/U protection ratios set forth above. (Note: Calculation of field strengths for distances less than 1.5 km should be based on free space propagation; calculation of "undesired" field strengths for distances between 1.5 km and 15 km should use the F(50,50) charts because the F(50,10) charts are valid only for distances of 15 kilometers or greater.) In practice, the calculations would be relatively simple and straight-forward and would yield a distance from the TV transmitter within which adjacent channel operation would be permitted and a distance beyond the edge of contour where both co- and adjacent operations would be acceptable.

We support this interference criterion and feel these criterions are more than adequate to protect the licensed station's protected service contour.

D. Permissible Channels for Unlicensed Operation

33. We believe it is generally desirable to allow unlicensed devices to access the largest practicable number of the 68 television channels. This would maximize the opportunities for operation of unlicensed devices in all areas, and would be particularly important for the successful implementation of unlicensed devices in areas where the TV bands are crowded with other services. There are, however, certain channels that we believe are, for the reasons discussed below, not suitable or appropriate for use by unlicensed devices. These include channels 2-4, 37, and 52-69. In addition, we tentatively conclude that channels 14-20 are not suitable for use in markets where they are used for PLMRS and CMRS. With the exception of these channels, we propose to allow unlicensed devices to operate on any unused TV channel. Thus, TV channels 5-36 and 38-51 would be generally available for unlicensed operation and channels 14-20 would be available in most locations.

Response:

We support the use of these channels for unlicensed operation. Additionally, we believe that the Commission has exercised extreme caution in making these TV channels available for unlicensed use.

34. Channels 2-4 are commonly used for, or are adjacent to, the output channels of TV interface devices such as videocassette recorders (VCRs), digital versatile disc (DVD) players and recorders, and cable and satellite terminal devices that connect to the antenna input terminals of TV receivers. Some of the commenting parties express concerns that unlicensed devices operating on channels 2-4 could be a source of interference to TV interface devices.[52] We are concerned that such interference is possible and that interference to the signals of TV interface devices could be disruptive to the various and important services that they support. We therefore are taking a conservative approach and proposing not to allow new unlicensed devices to operate on those channels at this time. Also, we are proposing not to allow unlicensed devices to operate on TV channel 37, due to the special interference concerns associated with the sensitive nature of radio astronomy reception and the critical safety function of medical telemetry equipment. In view of our reallocation of channels 52-69 from television to other services, we are further proposing not to allow unlicensed devices on those channels. While channels 52-69 continue to be used for TV broadcasting pending the completion of the DTV transition, they are now available for new uses in areas where they are not used for television service.[53] In order to avoid potential sharing difficulties between new uses and unlicensed operations, we believe the most prudent course is to simply preclude unlicensed devices from those channels from the outset of the new authorization proposed herein.

Response:

[52] *See* Consumer Electronics Association comments at 5, Radio Shack comments at 3, IEEE 802.18 RR-TAG comments at 3-4 and Information Technology Industry Council comments at 5.

[53] Frequencies in the channel 52-69 range are now allocated for public safety services (some licenses have been assigned), commercial services controlled by guard band managers (frequencies have been auctioned), and commercial mobile radio services (some frequencies have not yet been auctioned).

We thank the Commission for the clarity provided in Item 34 above. While we need all the spectrum that is available, there are other important services that need to operate unencumbered. Your careful consideration in these matters is appreciated and should be applauded by all involved..

35. As indicated above, parties representing the interests of public safety and land mobile operators that use channels 14-20 in 13 metropolitan areas in the country express concern that operation of unlicensed devices on these channels could result in interference to their operations. These parties state that it would be difficult for unlicensed devices to avoid interference to PLMRS and CMRS operations because many transmitters in those services are mobile, so that their exact location does not appear in a database.[54] Further, because transmitters in these services operate intermittently and unpredictably, they contend that it would not be possible for an unlicensed device using a "listen-before-talk" protocol to avoid causing interference to these services.[55] We agree that we should not propose to allow use of these channels in areas where they are used for PLMRS or CMRS operations. We note that generally only one or two TV channels are used by the PLMRS and CMRS in a given area. Further, the number of geographic areas where such use occurs, and both the channel numbers and geographic locations where it occurs are generally known.[56] The same approach that we propose to prevent operation on occupied TV channels can also prevent operation on channels shared with the PLMRS and CMRS in metropolitan areas where they use TV channels. Therefore, we propose to allow unlicensed devices to operate on channels 14-20, except in areas where a particular channel is used for TV services or PLMRS and CMRS operations.

Response:

We support the use of these channels for unlicensed operation where TV services or PLMRS and CMRS operations are not using this spectrum.

36. PLMRS and CMRS base stations are assigned within 80 kilometers (50 miles) of the center of the cities where they are permitted to operate on channels 14-20 (470-512 MHz), and mobile units may be operated within 48 kilometers (30 miles) of their associated base station or stations.[57] Thus, mobile stations may be operated at up to 128 kilometers (80 miles) from the city center. Using the same criteria specified in the Commission's rules for protection of land mobile operations from LPTV, we

[54] *See,* for example, Port Authority of New York and New Jersey comments at 4-5, Motorola comments at 5, American Mobile Telecommunication Association comments at 3, Association of Public Safety Communications Officials comments at 2, City and County of San Francisco comments at 1-3, Land Mobile Communications Council comments at 4-8, Los Angeles County comments at 3-5 and DuPage Public Safety Communications comments at 1-2.

[55] *Id.*

[56] *See* 47 C.F.R. § 90.303. We note, however, that there are several licensed land mobile operators, including public safety entities, that currently operate, pursuant to waiver, on defined channels in channels 14-20 at specified locations outside those markets specifically designated in the Part 90 rules. *See, e.g.*, Goosetown Enterprises Inc., 16 FCC Rcd 12792 (2001).

[57] *See* 47 C.F.R. § 90.305.

propose not to allow unlicensed devices to operate within 134 km or 131 km from the center coordinates of metropolitan areas where PLMRS/CMRS services operate on co- and adjacent channels, respectively.[58]

Response:

We support the Commission in this proposal and the use of these channels for unlicensed operation outside the 131 Km limit.

37. We seek comment on our proposals for the TV channels that would be available for unlicensed use. We also request comment on whether the proposed minimum separations to protect PLMRS/CMRS operations are appropriate, and in particular, what special protections, if any, are necessary to accommodate these operations, including those operations that are licensed pursuant to a waiver.[59]

Response:

We support the use of these channels for unlicensed operation. Bandpass filtering will provide adequate protection for the operation of PLMRS/CMRS Services now existing.

E. Wireless Microphone Operations

38. As noted above, manufacturers of wireless microphones express concern that operation of new unlicensed devices in the TV bands could cause interference to wireless microphones.[60] We believe that the operational characteristics of wireless microphones significantly reduce the likelihood of interference from unlicensed devices for several reasons. Wireless microphones are permitted relatively high output power given the range over which they are typically operate. The maximum permitted output power of these devices is 50 milliwatts in the VHF band and 250 milliwatts in the UHF band.[61] Wireless microphones are used in locations such as theaters and sports arenas where the operating range would typically be hundreds of feet at the most, so operation at the power levels permitted in the rules results in a significant signal level at the wireless microphone receiver. Further, the vast majority of wireless microphones are frequency modulated (FM). FM receivers exhibit a "capture effect" in which they respond to only the strongest signal received on a frequency and reject any weaker interfering signals. Because the desired signal at a wireless microphone receiver is relatively strong, we believe that the likelihood of interference from unlicensed device signals is therefore low such that unlicensed use should generally be compatible with wireless microphones. Nonetheless, we seek comment on whether other measures are needed to protect wireless microphone operation including the possibility of designating one or two unused TV channels in each market for use by only wireless microphones.

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[58] Under this approach, PLMRS/CMRS operations would be protected within the 130 kilometers radius from the city center coordinates permitted under the rules. As is the case for LPTV, the field strength from an unlicensed device on a co- or adjacent channel would not be permitted to exceed 52 dBu or 76 dBu, respectively, at the 130 km protected contour of the PLMS/CMRS metropolitan area. *See* 47 C..F.R. § 74.709(d).

[59] *See supra* note 56.

[60] *See* Shure comments at 9 and Shure reply comments at 2-6.

[61] *See* 47 C.F.R. §§ 74802(a) and 74.861(e).

Response:

We support this interference criterion, and do not support other measures to protect wireless microphone operation. We support designating one or two unused TV channels in each market for use by only wireless microphones.

F. Other Issues

39. *Out of Band Emission Limits.* We propose to require that unlicensed devices operating in the TV bands comply with the same out-of-band emission limits that apply to other Part 15 digital transmission system transmitters. These limits seem appropriate given that we are proposing power and antenna characteristics for unlicensed devices in the TV bands that are similar to those for other Part 15 devices that employ digital modulation. Specifically, we propose to require that out-of-band emissions in any 100 kHz bandwidth outside the frequency band in which the unlicensed device operates be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of the desired power.[62] Consistent with the current rules, we also propose to not require attenuation of emissions below the general limits specified in Section 15.209(a).[63] To reduce the likelihood of harmful interference to licensed services on adjacent channels or outside the TV bands, we further propose to require that emissions outside the TV channel(s) where an unlicensed device operates comply with the general limits in Section 15.209(a). This is consistent with the out-of-band emission requirements for certain other Part 15 intentional radiators.[64] We seek comment on these proposals.

Response:

We support these Out of Band Emission Limits.

40. *Security Requirements*. As the Commission noted in the cognitive radio proceeding, equipment that relies on new capabilities such as geo-location raises the possibility of new types of abuse, such as reprogramming GPS receivers with geographic offsets or altering database information.[65] In addition, the software used to select the appropriate operating parameters could be altered to make an unlicensed device transmit at frequencies, power levels or locations where it should not.[66] To prevent devices from being modified to transmit on occupied frequencies and causing harmful interference to licensed services, we propose to require that an unlicensed device that operates in the TV bands have certain capabilities to ensure that it can not be easily modified. Specifically, we propose to require that an unlicensed device not have any controls accessible to any party, other than a professional installer, that allow selection of the transmit channel or output power. We also propose to require that manufacturers of unlicensed devices that operate in the TV bands take steps to ensure that only the software that was approved with a device can be loaded into a device, and that the software not allow the user to operate the device with parameters outside those that were approved. This proposed requirement would apply to

[62] *See* 47 C.F.R. § 15.247(c).

[63] *See* 47 C.F.R. § 15.209.

[64] *See* 47 C.F.R. § 15.209(b).

[65] *See Notice of Proposed Rule Making and Order* in ET Docket No. 03-108, 18 FCC Rcd 26859 (2003).

[66] *Id.*

software that selects a device's operating frequency, to software used in determining a device's geographic location or identifying TV channels that are vacant, and to the information in the database accessed by a device. We further propose to require that an unlicensed device incorporate a means to detect whether tampering with the hardware or software has occurred, and that a device not operate if tampering is detected. We also propose to require that manufacturers describe their device's security features in the application for equipment authorization. We seek comment on these proposals. In particular, we seek comment on the steps manufacturers could take to protect hardware and software from modifications for improper purposes and how tampering with hardware or software could be detected.

Response:

These requirements seem reasonable. However, the statement "We further propose to require that an unlicensed device incorporate a means to detect whether tampering with the hardware or software has occurred, and that a device not operate if tampering is detected." **This suggests that a major portion of an existing network shutdown if a given device detects possible tampering. These devices should first alarm and identify a possible tampering event, or out of specifications operation, to the operator. This would give a system operator of unlicensed devices an opportunity to analyze and correct any out-of-specification operation that may cause possible interference to a TV spectrum broadcast operator. Requiring the immediate shutdown of some out of specification operation, which may cause interference, is excessive and seems to be interfering in the fair competition and operation of a business.**

41. *Compliance and Enforcement*. We propose to subject unlicensed devices operated under the proposals herein to the general operating conditions in Section 15.5 that an unlicensed not cause harmful interference and that it must accept interference caused by the operation of an authorized radio station. The operator of an unlicensed device operating under the rules proposed herein would be required to cease operation upon notification by a Commission representative that the device was causing harmful interference, regardless or whether the device was otherwise in compliance with the rules, until such time as the condition causing the harmful interference was corrected. We also ask whether we should hold parties that provide information on channel availability to unlicensed devices responsible for the validity of that information. To what extent should these parties be able to rely on information obtained from the Commission? In cases where errors or other inaccuracies were found in such data, we would require the responsible party to cease distributing the control information when advised that it is incorrect by a Commission representative. Such party would be allowed to resume distribution of channel availability information if and when that information was corrected. We request comment on these proposals for ensuring that harmful interference is not caused by the operation of these devices and the enforcement of the rules we are proposing for unlicensed operation on vacant channels. We also invite interested parties to submit comments and suggestions regarding any other possible enforcement mechanisms that might be appropriate and effective for unlicensed devices operating in the broadcast TV bands.

Response:

We strongly support Voluntary Compliance and Enforcement. This has worked well in the past. We support the Commission holding parties that provide information on channel availability to unlicensed devices responsible for the validity of that information. Voluntary compliance and Enforcement only works if all parties to the compliance and enforcement cooperate and provide accurate and reliable information to the participating parties.

The disseminating parties should be able to rely on information obtained from the commission to the extent that if the party informs an unlicensed operator that a specific channel is available in a specified area; that unlicensed operator should be able to commence operation of a system without concern that the unlicensed radiating devices will cause harmful interference to TV Station operators or the receivers of their signals.

When inaccurate information has been disseminated and the circulating party has been informed of the inaccuracy of that information the disseminating party must correct the inaccuracies and inform the commission of their correction and what information was corrected.

We believe that the proposed enforcement mechanisms are appropriate and adequate for the effective operation of unlicensed devices to operate successfully in the broadcast TV bands.

42. *Measurement/Testing Procedures*. Unlicensed transmitters must be tested to show compliance with the applicable technical requirements in Part 15 of the rules before they can be certified. Part 15 specifies general testing requirements applicable to unlicensed transmitters and incorporates some industry procedures into the rules by reference, such as the American National Standards Institute (ANSI) C63.4-2001 measurement procedure.[67] The types of tests required typically include the maximum output power or field strength, spurious emissions, occupied bandwidth and operating frequency.

Response:

We support the implementation of the Part 15 rules specifying general testing requirements for certification. No additional testing should be required beyond the maximum output power or field strength, spurious emissions, occupied bandwidth, and operating frequency.

43. As we noted in the cognitive radio proceeding, the output of most transmitters is tested in response to a single or limited number of input conditions to show compliance with the rules under which they will be operated.[68] For unlicensed devices operating in the TV bands, we believe that the current testing requirements are adequate to determine the compliance of many device operating parameters, including the output power level and spurious emissions. However, because we are proposing requirements for unlicensed devices in the TV band that were not envisioned at the time the current rules were developed, it may be necessary to specify additional compliance tests to ensure the compliance of these devices. Specifically, additional tests may be required in the following areas:

- Ability of a device to identify its geographic location within a specified limit of accuracy
- Ability of a device to access a database to correctly determine the location of other transmitters in its vicinity and select the appropriate operating frequency
- Ability of a sensing receiver to detect the presence of other signals and select the appropriate operating frequency

[67] *See* 47 C.F.R. § 15.31 through 15.35.

[68] *See Notice of Proposed Rule Making and Order* in ET Docket No. 03-108, 18 FCC Rcd 26859 (2003).

Response:

While these three (3) listed requirements may be available with the development of 'cognitive radios, in the case of unlicensed devices operating in the TV bands, the written location of such devices should be able to be reported to the commission.

To reiterate a point made above, notwithstanding the afore going arguments, if "Cognitive Radio" becomes "the solution" for operation of unlicensed devices in the TV Spectrum; it should not limit the efforts of the FCC and industry that are currently engaged in opening new spectrum for use by Unlicensed devices.

44. We expect that any new testing procedures would be specified at the time any rules are adopted, as the Commission did in the proceeding making additional spectrum available for unlicensed devices in the 5 GHz band.[69] We seek comment on any new tests that may be required for unlicensed devices that operate in the TV bands and on the appropriate testing procedures.

Response:

We do not believe that additional testing procedures need to be specified.

45. *Certification by TCBs.* Unlicensed transmitters operating under Part 15 of the rules are required to be certified by the Commission or a designated Telecommunication Certification Body (TCB) before they may be legally marketed within the United States.[70] In establishing the requirements and rules for TCBs, the Commission stated that while it intended to allow TCBs to certify a broad range of equipment, certain functions should continue to be performed by the Commission.[71] These functions include certifying new or unique equipment for which the rules or requirements do not exist or for which the application of the rules is not clear.[72] Because unlicensed devices operating in the TV bands would contain new technologies and we are proposing new rules to accommodate them, we expect that many questions about the application of the rules would arise. Consistent with the Commission's previous action in the software defined radio proceeding, we tentatively conclude that TCBs should not be permitted to certify unlicensed devices that operate in the TV bands until the Chief of the Office of Engineering and Technology issues a public notice announcing that TCBs may certify such devices.[73] We seek comment on this tentative conclusion.

Response:

[69] *See Report and Order* in ET Docket No. 03-122, 18 FCC Rcd 24484 (2003).

[70] *See* 47 C.F.R. §§ 15.201(b) and 2.960.

[71] *See Report and Order* in ET Docket No. 98-68, 13 FCC Rcd 24687 (1999).

[72] *Id.*

[73] *See First Report and Order* in ET Docket No. 00-47, 16 FCC Rcd 17373 (2001).

We support this position that TCBs should not be permitted to certify unlicensed devices that operate in the TV bands until the Chief of the Office of Engineering and Technology issues a public notice announcing that TCBs must certify such devices.

46. *Unlicensed Use in Border Areas near Canada and Mexico.* The allotment and assignment of TV channels in the border areas with Canada and Mexico are subject to agreements with each of those countries. Low power TV assignments within 32 kilometers (20 miles) of the Canadian border must be referred to the Canadian authorities for approval.[74] In addition, low power UHF TV stations that are located less than 40 kilometers (25 miles) from the Mexican border, and low power VHF TV stations that are less than 60 kilometers (37 miles) from the Mexican border, must be referred to the Mexican government for approval.[75] In keeping with the current agreements with Canada and Mexico, we propose to prohibit unlicensed fixed/access devices from operating less than these distances from the Canadian and Mexican borders until agreements are reached with those countries. We seek comment on this proposal. In particular, we request comment on how to ensure that unlicensed devices using vacant TV channels do not operate within the border areas, whether the methods used to ensure that these devices operate only on vacant TV channels could be adapted to preclude operation in the border areas, or whether some other methods would be more appropriate in this regard.

Response:

We fully support current agreements with Canada and Mexico and recommend the Commission adopt Item 46. – *Unlicensed Use in Border Areas near Canada and Mexico.* ***– Above.***

47. *Need for Voluntary Standards.* Unlicensed devices operating under Part 15 of the rules have no protection from interference from other unlicensed devices.[76] In bands that are heavily used by unlicensed devices such as the spread spectrum bands under Section 15.247 of the rules, industry bodies have developed voluntary standards that facilitate spectrum sharing between unlicensed devices, such as the IEEE 802.11 standards. We seek comment on whether there is a need for such voluntary standards to facilitate sharing between unlicensed users in the TV bands. If so, how should such voluntary standards be developed and what should the Commission's role, if any, be in such a process to make certain that the standards remain current and support innovation?

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[74] *See Working Arrangement for Allotment and Assignment of VHF and UHF Television Broadcasting Channels under the Agreement between the Government of the United States of America and the Government of Canada Relating to the TV Broadcasting Service,* dated March 1, 1989. This agreement is available on the Commission's we site at http://www.fcc.gov/ib/sand/agree/files/can-bc/can-tv.pdf.

[75] *See Agreement Amending the Agreement Relating to Assignments and Usage of Television Broadcasting Channels in the Frequency Range 470-806 MHz (Channels 14-69) along the United States-Mexico Border,* dated November 21, 1988. This agreement is available on the Commission's web site at http://www.fcc.gov/ib/sand/agree/files/mex-bc/lpuhfbc.pdf. *See* also the untitled amendment to the United States-Mexican agreement on VHF stations dated September 14-26, 1988, available on the Commission's web site at http://www.fcc.gov/ib/sand/agree/files/mex-bc/lpvhfbc.pdf. The agreements may require coordination at greater distances from the border depending on the ERP and HAAT of the LPTV station. The distances we specify are the minimums specified in the agreements because those distances would apply to a station with the proposed maximum unlicensed device power of 1 watt into a 6 dBi gain antenna (2.43 watts ERP).

[76] *See* 47 C.F.R. § 15.5(b).

Response:

We strongly support and advise that the FCC (Commission) should adopt voluntary standards as presently exist under Section 15.247 of the rules.

IV. PROCEDURAL MATTERS

48. *Initial Regulatory Flexibility Analysis*. As required by the Regulatory Flexibility Act, *see* 5 U.S.C. § 603, the Commission has prepared an Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on small entities of the policies and rules proposed in this document. The IRFA is set forth in Appendix C. Written public comments are requested on the IRFA. These comments must be filed in accordance with the same filing deadlines as comments filed in response to this Notice of Proposed Rule Making as set forth in paragraph 51, and have a separate and distinct heading designating them as responses to the IRFA.

49. *Initial Paperwork Reduction Act of 1995 Analysis*. This Notice contains a proposed information collection. As part of its continuing effort to reduce paperwork burdens, we invite the general public and the Office of Management and Budget (OMB) to take this opportunity to comment on the information collections contained in this NPRM, as required by the Paperwork Reduction Act of 1995, Public Law 104-13. Public and agency comments are due at the same time as other comments on this NPRM; OMB comments are due 60 days from date of publication of this NPRM in the Federal Register.

50. *Ex Parte Presentations*. This is a permit-but-disclose notice and comment rule making proceeding. *Ex parte* presentations are permitted, except during the Sunshine Agenda period, provided they are disclosed as provided in the Commission's rules. *See generally* 47 C.F.R. §§ 1.1202, 1.1203, and 1.2306(a).

51. *Filing Comments*. Pursuant to Sections 1.415 and 1.419 of the Commission's rules, 47 C.F.R. §§ 1.415, 1.419, interested parties may file comments on or before [75 days from publication in Federal Register], and reply comments on or before [105 days from publication in Federal Register]. Comments may be filed using the Commission's Electronic Comment Filing System (ECFS) or by filing paper copies. See Electronic Filing of Documents in Rulemaking Proceedings, 63 Fed. Reg. 24121 (1998).

52. Comments filed through the ECFS can be sent as an electronic file via the Internet to http://www.fcc.gov/cgb/ecfs/. Generally, only one copy of an electronic submission must be filed. If multiple docket or rulemaking numbers appear in the caption of this proceeding, however, commenters must transmit one electronic copy of the comments to each docket or rulemaking number referenced in the caption. In completing the transmittal screen, commenters should include their full name, U.S. Postal Service mailing address, and the applicable docket or rulemaking number. Parties may also submit an electronic comment by Internet e-mail. To get filing instructions for e-mail comments, commenters should send an e-mail to ecfs@fcc.gov, and should include the following words in the body of the message, "get form." A sample form and directions will be sent in reply. Parties who choose to file by paper must file an original and four copies of each filing. If more than one docket or rulemaking number appears in the caption of this proceeding, commenters must submit two additional copies for each additional docket or rulemaking number.

53. Filings can be sent by hand or messenger delivery, by commercial overnight courier, or by first-class or overnight U.S. Postal Service mail (although we continue to experience delays in receiving U.S. Postal Service mail).

54. The Commission's contractor, Natek, Inc., will receive hand-delivered or messenger-delivered paper filings for the Commission's Secretary at 236 Massachusetts Avenue, N.E., Suite 110, Washington, D.C. 20002.

-The filing hours at this location are 8:00 a.m. to 7:00 p.m.

-All hand deliveries must be held together with rubber bands or fasteners.

-Any envelopes must be disposed of before entering the building.

-Commercial overnight mail (other than U.S. Postal Service Express Mail and Priority Mail) must be sent to 9300 East Hampton Drive, Capitol Heights, MD 20743.

-U.S. Postal Service first-class mail, Express Mail, and Priority Mail should be addressed to 445 12th Street, SW, Washington, D.C. 20554.

-All filings must be addressed to the Commission's Secretary, Office of the Secretary, Federal Communications Commission.

55. Written comments by the public on the proposed and/or modified information collections are due [75 days from publication in the Federal Register]. Written comments must be submitted by the Office of Management and Budget (OMB) on the proposed and/or modified information collections on or before [105 days after date of publication in the Federal Register.] In addition to filing comments with the Secretary, a copy of any comments on the information collection(s) contained herein should be submitted to Judith Boley Herman, Federal Communications Commission, Room 1-C804, 445 12th Street, SW, Washington, DC 20554, or via the Internet to jboley@fcc.gov and to Kristy L. Lalonde, OMB Desk Officer, Room 10236 NEOB, 725 17th Street, N.W., Washington, DC 20503 or via the Internet to Kristy L. Lalonde@omb.eop.gov.

56. Parties who choose to file by paper should also submit their comments on diskette. Such a submission should be on a 3.5-inch diskette formatted in an IBM compatible format using Microsoft Word or compatible software. The diskette should be accompanied by a cover letter and should be submitted in “read only” mode. The diskette should be clearly labeled with the commenter’s name, proceeding (including the lead docket number, type of pleading (comment or reply comment), date of submission, and the name of the electronic file on the diskette. The label should also include the following phrase "Disk Copy – Not an Original." Each diskette should contain only party’s pleading, preferably in a single electronic file. In addition, commenters must send diskette copies to the Commission’s copy contractor, Natek Inc., Portals II, 445 12th Street, SW, Room CY-B402, Washington, DC, 20554.

57. Alternative formats (computer diskette, large print, audio cassette and Braille) are available to persons with disabilities by contacting Brian Millin at (202) 418-7426, TTY (202) 418-2555, or via e-mail to Brian.Millin@fcc.gov. This Notice can also be downloaded at http://www.fcc.gov/oet.

V. ORDERING CLAUSES

58. IT IS ORDERED that, pursuant to Sections 4(i), 302, 303(e), 303(f), 303(r) and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 302, 303(e), 303(f), 303(r) and 307, this Notice of Proposed Rule Making IS HEREBY ADOPTED.

59. IT IS FURTHER ORDERED that the Commission's Consumer and Governmental Affairs Bureau, Reference Information Center, SHALL SEND a copy of this notice, including the Initial Regulatory Flexibility Analysis, to the Chief Counsel for Advocacy of the Small Business Administration.

60. For further information regarding this Notice of Proposed Rule Making, contact Mr. Hugh L. Van Tuyl, Office of Engineering and Technology, (202) 418-7506, e-mail Hugh.VanTuyl@fcc.gov. or Mr. Alan Stillwell, Office of Engineering and Technology, (202) 418-2925, e-mail Alan.Stillwell@fcc.gov.

FEDERAL COMMUNICATIONS COMMISSION

Marlene H. Dortch
Secretary

APPENDIX A: PARTIES FILING COMMENTS IN RESPONSE TO NOTICE OF INQUIRY

Comments

1. National Telecommunications and Information Administration
2. Philips Medical Systems
3. Port Authority of New York and New Jersey
4. Alaska Broadcaster Association, et al.
5. Thomas C. Smith
6. Intersil Corporation and Symbol Technologies, Inc.
7. Shared Spectrum Company
8. Consumer Electronics Association
9. The Association for Maximum Service Television, Inc., the National Association of Broadcasters and the Association of Public Television Stations
10. Motorola, Inc.
11. RadioShack Corporation
12. Lans Service Corporation
13. Shure Incorporated
14. Atlantic Telecommunications
15. New America Foundation, et al
16. American Mobile Telecommunications Association
17. Sinclair Broadcast Group, Inc.
18. Coalition of Program Networks and Distributors, Broadcast Networks, Satellite Operators and Others
19. Intel Corporation
20. Cingular Wireless LLC
21. Software Defined Radio Forum
22. Rural 700 MHz Band Licensees
23. American Petroleum Institute
24. Association of Public Safety Communications Officials
25. AT&T Corporation
26. Ericsson, Inc.
27. Satellite Industry Association
28. IEEE 802.18 RR-TAG
29. The Wi-Fi Alliance
30. City and County of San Francisco
31. Cox Broadcasting, Inc.
32. The Land Mobile Communications Council
33. Comsearch
34. Bluetooth SIG
35. Information Technology Industry Council
36. Data Flow Systems, Inc.
37. Los Angeles County
38. Allen Petrin
39. National Academy of Sciences
40. DuPage Public Safety Communications
41. Sinclair Broadcast Group, Inc.
42. Wayne Longman
43. Cliff LeBoeuf
44. Robert Johansen/CC Net, Inc.
45. C. Crowley
46. David Blood
47. AMA Techtel Communications
48. John Hokenson
49. Tom Williams/Air Networking
50. Redline Communications/Mitch Vine
51. Kevin Rice
52. Lakeland Communications, Inc.
53. David Hughes/Old Colorado City Communications
54. Mutual Data Services, Inc.
55. New Gen Wireless, Inc.
56. Kerry Penland/Big Tube Wireless, LLC
57. Keith Schmidt
58. Chase 3000
59. Jason Hunt
60. R.W. Shepardson
61. David Lindsey
62. Eje Gustafsson
63. Mark Worstall
64. Netrepid
65. David MacKinnon/Mother Lode Internet
66. Qorvus Systems, Inc.
67. REC Networks
68. Alvarion, Inc.
69. Roy Preston
70. Nickolaus E. Leggett
71. David Robertson
72. Kerry Penland
73. Marlon K. Schafer
74. Scott Scriven
75. John D. Stanley

Reply Comments

1. IEEE 802.18 RR TAG
2. Sprint
3. Consumer Electronics Association
4. Alvarion, Inc.
5. AT&T Wireless Services, Inc.
6. Cellular Telecommunications and Internet Association
7. Intel Corporation
8. New America Foundation, et. al.
9. Blooston Private User Group
10. The Rural 700 MHz Band Licensees
11. The Association for Maximum Service Television, Inc., the National Association of Broadcasters and the Association of Public Television Stations
12. American Mobile Telecommunications Association, Inc.
13. United Telecom Council
14. License Exempt Alliance
15. American Hospital Association Task Force on Medical Telemetry
16. New York State Office for Technology
17. Microsoft Corporation
18. Max Vilimpoc
19. Qualcomm Incorporated
20. Shure Incorporated
21. Satellite Industry Association
22. Intersil Corporation and Symbol Technologies, Inc.
23. Industrial Telecommunications Association
24. City and County of San Francisco
25. Electronic Frontier Foundation
26. REC Networks

APPENDIX B: PROPOSED RULES

Part 15 of Title 47 of the Code of Federal Regulations is proposed to be amended as follows:

1. The authority citation of Part 15 continues to read as follows:

   AUTHORITY: 47 U.S.C. 154, 302, 303, 304, 307, 336, and 544A.

2. A new Section 15.244 is proposed to be added to read as follows:

§ 15.244 Operation within the bands 76-88 MHz, 174-216 MHz, 470-608 MHz and 614-698 MHz

(a) The fundamental emissions from intentional radiators operated under this section shall be confined to one or more contiguous television broadcast channels as defined in part 73 of this chapter.

(b) The maximum conducted output power for fixed devices is 1 watt peak. The maximum conducted output power for portable devices is 100 milliwatts peak.

(c) If transmitting antennas of directional gain greater than 6 dBi are used, the peak output power specified in paragraph (b) shall be reduced by the amount in dB that the directional gain of the antenna exceeds 6 dBi.

(d) In any 100 kHz bandwidth outside the frequency band in which the intentional radiator is operating, the radio frequency power that is produced by the intentional radiator shall be at least 20 dB below that in the 100 kHz bandwidth within the band that contains the highest level of desired power, based on either an RF conducted or radiated measurement. Attenuation below the general limits specified in §15.209(a) is not required. 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).

(e) An intentional radiator used for fixed operation must comply with one of the following subparagraphs:

(1) The intentional radiator shall incorporate a GPS receiver to determine the geographic coordinates at its location with an accuracy of +/- 10 meters. The intentional radiator shall have the capability of accessing a database and computational software to determine the TV channels that are vacant at its location. The device must have the capability to limit its transmissions to only those channels that are identified as unused.

(2) The intentional radiator must be professionally installed by a party that will determine the device's geographic location and the available unused TV channels at that location. The installing party will configure the device to operate on only unused channels. The unlicensed device or its operator must periodically access a channel availability database and computational software to ensure that the channels on which the device operates remain unused.

(f) An intentional radiator used for portable operation must be capable of receiving a control signal from an unlicensed transmitter, or a TV or FM broadcast station indicating the TV channel(s) that are vacant within the service area of the unlicensed transmitter, TV or FM station. The intentional radiator must transmit only on channels(s) that are designated as vacant. The intentional radiator shall not operate if no unoccupied frequency band is available within its frequency range of operation or if it does not detect any unlicensed transmitters, FM or TV broadcast stations transmitting channel availability information.

(g) An intentional radiator must protect TV stations from harmful interference within the following service contours.

Type of station	Protected contour		
	Channel	Contour (dBu)	Propagation curve
Analog TV	Low VHF (2-6)	47	F(50,50)
	High VHF (7-13)	56	F(50,50)
	UHF (14-69)	64	F(50,50)
Analog Class A, LPTV, translator and booster	Low VHF (2-6)	62	F(50,50)
	High VHF (7-13)	68	F(50,50)
	UHF (14-69)	74	F(50,50)
Digital TV	Low VHF (2-6)	28	F(50,90)
	High VHF (7-13)	36	F(50,90)
	UHF (14-51)	41	F(50,90)
Digital Class A	Low VHF (2-6)	43	F(50,90)
	High VHF (7-13)	48	F(50,90)
	UHF (14-51)	51	F(50,90)

A TV channel will be considered vacant for use by an intentional radiator operating under the provisions of this section if the following desired-to-undesired (D/U) signal ratios between co-channel and adjacent channel TV stations and the intentional radiator are met at all points within the service area of the unlicensed transmitter, TV or FM broadcast station that transmits channel availability information.

Type of station	Protection ratios		
	Channel separation	D/U ratio (dB)	Propagation curve
Analog TV, Class A, LPTV, translator and booster	Co-channel	34	F(50,10)
	Upper adjacent	-17	F(50,50)
	Lower adjacent	-14	F(50,50)
Digital TV and Class A	Co-channel	23	F(50,10)
	Upper adjacent	-26	F(50,50)
	Lower adjacent	-28	F(50,50)

(h) Operation is not permitted within the service contours of co-channel stations. Portable devices are not required to comply with the D/U ratios for TV stations operating on adjacent channels. Fixed devices are not required to comply with the adjacent channel D/U ratios between channels 4 and 5, channels 6 and 7, and channels 13 and 14 because of the frequency separations that exist between those channels. For adjacent channel operation within the protected service contour of a television station, calculation of desired signal levels shall be based on FCC F(90,90) curves or the protected contour field strength value, whichever is higher. For unlicensed operation outside the protected contour of a television station, calculations of television (desired) signal levels would be based on the FCC F(50,50) curves. Calculations of unlicensed (undesired) signal levels would be based on the FCC F(50,50) curves or other appropriate models.

(i) Operation on a TV channel shared with the PLMRS or CMRS is permitted only if every point in the reception area of an unlicensed transmitter, or a TV or FM station that transmits channel availability information is separated by the following distances from the of the center coordinates of the metropolitan areas where shared operation is permitted: 134 kilometers for co-channel operation and 131 kilometers for adjacent channel operation.

(j) Operation of fixed devices under the provisions of this section is not permitted on VHF channels within 32 kilometers of the border with Mexico, on UHF channels within 40 kilometers of the

border with Mexico, or on either VHF or UHF channels within 60 kilometers of the border with Canada.

(k) Devices operating under the provisions of this section shall be equipped with a means to automatically and periodically transmit a unique identification signal. Devices must not be equipped with any controls accessible to any party, other than a professional installer, that allow selection of the transmit channel or output power. Devices must include features to ensure that only the software that was approved with a device can be loaded into a device, and the software may not allow the user to operate the device with parameters outside those that were approved. "Software" in this context includes the software that selects a device's operating frequency, software used in determining a device's geographic location or identifying TV channels that are vacant, and to the information in the database accessed by a device. Devices must incorporate a means to detect whether tampering with the hardware or software has occurred and must not operate if tampering is detected. The application for certification must describe how the device complies with these requirements.

APPENDIX C: INITIAL REGULATORY FLEXIBILITY ANALYSIS

As required by the Regulatory Flexibility Act of 1980, as amended (RFA),[77] the Commission has prepared this present Initial Regulatory Flexibility Analysis (IRFA) of the possible significant economic impact on a substantial number of small entities small entities by the policies and rules proposed in this Notice of Proposed Rule Making (Notice). Written public comments are requested on this IRFA. Comments must be identified as responses to the IRFA and must be filed by the deadlines for comments on the Notice provided in paragraph 51 of the item. The Commission will send a copy of the Notice, including this IRFA, to the Chief Counsel for Advocacy of the Small Business Administration (SBA).[78] In addition, the Notice and IRFA (or summaries thereof) will be published in the Federal Register.[79]

A. Need for, and Objectives of, the Proposed Rules

This Notice would propose to allow unlicensed devices to operate in the TV broadcast bands at locations where spectrum is not being used by licensed services. The Notice would propose to require unlicensed devices to incorporate "smart radio" features" to prevent harmful interference from unlicensed devices to licensed services. For the purpose of developing interference protection criteria, the Notice would propose to classify unlicensed broadband devices to be used in the TV bands into two general functional categories. The first category would consist of lower power "personal/portable" unlicensed devices, such as Wi-Fi like cards in laptop computers or wireless in-home LANs. The second category would consist of higher power "fixed/access" unlicensed devices that are generally operated from a fixed location and may be used to provide a commercial service such as wireless broadband internet access.

These proposals, if adopted, will prove beneficial to manufacturers and users of unlicensed technology, including those who provide services to rural communities. Specifically, we note that a growing number of wireless internet service providers (WISPs) are using unlicensed devices within wireless networks to serve the needs of consumers. WISPs around the country are providing an alternative high-speed connection in areas where cable or DSL services have been slow to arrive. The additional frequency bands where operation is proposed will help to foster a viable last mile solution for delivering Internet services, other data applications, or even video and voice services to underserved, rural, or isolated communities. In addition, TV frequencies, which are below 900 MHz, have less signal attenuation through foliage and walls than frequencies above 900 MHz currently used by WISPs, thus affording improved signal coverage.

B. Legal Basis

The proposed action is authorized under Sections 4(i), 301, 302, 303(e), 303(f), 303(r), 304 and 307 of the Communications Act of 1934, as amended, 47 U.S.C. Sections 154(i), 301, 302, 303(e), 303(f), 303(r), 304 and 307.

C. Description and Estimate of the Number of Small Entities To Which the Proposed Rules Will Apply

[77] *See* 5 U.S.C. § 603. The RFA, *see* 5 U.S.C. §§ 601 – 612, has been amended by the Small Business Regulatory Enforcement Fairness Act of 1996 (SBREFA), Pub. L. No. 104-121, Title II, 110 Stat. 857 (1996).

[78] *See* 5 U.S.C. § 603(a).

[79] *See* 5 U.S.C. § 603(a).

The RFA directs agencies to provide a description of, and, where feasible, an estimate of the number of small entities that may be affected by the proposed rules, if adopted.[80] The RFA defines the term "small entity" as having the same meaning as the terms "small business," "small organization," and "small business concern" under Section 3 of the Small Business Act.[81] Under the Small Business Act, a "small business concern" is one that: (1) is independently owned and operated; (2) is not dominant in its field of operations; and (3) meets may additional criteria established by the Small Business Administration (SBA).[82]

Radio and Television Broadcasting and Wireless Communications Equipment Manufacturers

The Commission has not developed a definition of small entities applicable to unlicensed communications devices manufacturers. Therefore, we will utilize the SBA definition application to manufacturers of Radio and Television Broadcasting and Communications Equipment. Under the SBA's regulations, a Radio and Television Broadcasting and Wireless Communications Equipment Manufacturer must have 750 or fewer employees in order to qualify as a small business concern.[83] Census Bureau data indicate that there are 1,215 U.S. establishments that manufacture radio and television broadcasting and wireless communications equipment, and that 1,150 of these establishments have fewer than 500 employees and would be classified as small entities.[84] The remaining 65 establishments have 500 or more employees; however, we are unable to determine how many of those have fewer than 750 employees and, therefore, also qualify as small entities under the SBA definition. We therefore conclude that there are at least 1,150 small manufacturers of radio and television broadcasting and wireless communications equipment, and possibly there are more that operate with more than 500 but fewer than 750 employees.

Wireless Service Providers.

The SBA has developed a small business size standard for wireless firms within the two broad economic census categories of "Paging"[85] and "Cellular and Other Wireless Telecommunications."[86] Under both SBA categories, a wireless business is small if it has 1,500 or fewer employees. For the census category of Paging, Census Bureau data for 1997 show that there were 1,320 firms in this category, total, that operated for the entire year.[87] Of this total, 1,303 firms had employment of 999 or fewer employees, and

[80] *See* 5 U.S.C. § 603(b)(3).

[81] *Id.* § 601(3).

[82] 15 U.S.C. § 632.

[83] 13 C.F.R. § 121.201, NAICS code 334220.

[84] Economics and Statistics Administration, Bureau of Census, U.S. Department of Commerce, 1997 Economic Census, Industry Series - Manufacturing, Radio and Television Broadcasting and Wireless Communications Equipment Manufacturing, Table 4 at 9 (1999). The amount of 500 employees was used to estimate the number of small business firms because the relevant Census categories stopped at 499 employees and began at 500 employees. No category for 750 employees existed. Thus, the number is as accurate as it is possible to calculate with the available information.

[85] 13 C.F.R. § 121.201, NAICS code 513321 (changed to 517211 in October 2002).

[86] 13 C.F.R. § 121.201, NAICS code 513322 (changed to 517212 in October 2002).

[87] U.S. Census Bureau, 1997 Economic Census, Subject Series: "Information," Table 5, Employment Size of Firms Subject to Federal Income Tax: 1997, NAICS code 513321 (issued October 2000).

an additional 17 firms had employment of 1,000 employees or more.[88] Thus, under this category and associated small business size standard, the majority of firms can be considered small. For the census category Cellular and Other Wireless Telecommunications, Census Bureau data for 1997 show that there were 977 firms in this category, total, that operated for the entire year.[89] Of this total, 965 firms had employment of 999 or fewer employees, and an additional 12 firms had employment of 1,000 employees or more.[90] Thus, under this second category and size standard, the majority of firms can, again, be considered small.

D. Description of Projected Reporting, Recordkeeping, and Other Compliance Requirements

Unlicensed transmitters are already required to be authorized under the Commission's certification procedure as a prerequisite to marketing and importation, and the proposals in this proceeding would not change that requirement. There would, however, be several changes to the compliance requirements.[91]

Unlicensed transmitters capable of operating in the TV bands would have to incorporates features to ensure that they operate on only vacant channels. A transmitter used for fixed operation would have to incorporate a GPS receiver to determine its location and would have to access a database and computational software to determine which TV channels are vacant at its location. Alternatively, an unlicensed transmitter would not have to incorporate these features if it is professionally installed and the installer determines the geographic coordinates of the transmitter, determines which TV channels are vacant at that location, and adjusts the transmitter to operate on only those vacant channels. Portable unlicensed devices would have to be capable of receiving receive a signal from a fixed unlicensed transmitter, or a local FM or TV station indicating which TV channels are vacant in that area. If the unlicensed device did not detect a signal with this channel availability information, or if no vacant channels were available at its location, the unlicensed device would not be allowed to operate. In addition, any unlicensed transmitter used in the TV bands would have to incorporate features to prevent unauthorized modifications that could cause it to operate on occupied frequencies and therefore cause harmful interference. The applicant for certification would have to demonstrate in the application that the equipment meets these requirements.

E. Steps Taken to Minimize Significant Economic Impact on Small Entities, and Significant Alternatives Considered

The RFA requires an agency to describe any significant, specifically small business, alternatives that it has considered in reaching its proposed approach, which may include the following four alternatives (among others): "(1) the establishment of differing compliance or reporting requirements or timetables that take into account the resources available to small entities; (2) the clarification, consolidation, or simplification of compliance and reporting requirements under the rule for such small

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[88] U.S. Census Bureau, 1997 Economic Census, Subject Series: "Information," Table 5, Employment Size of Firms Subject to Federal Income Tax: 1997, NAICS code 513321 (issued October 2000). The census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is "Firms with 1000 employees or more."

[89] U.S. Census Bureau, 1997 Economic Census, Subject Series: "Information," Table 5, Employment Size of Firms Subject to Federal Income Tax: 1997, NAICS code 513322 (issued October 2000).

[90] U.S. Census Bureau, 1997 Economic Census, Subject Series: "Information," Table 5, Employment Size of Firms Subject to Federal Income Tax: 1997, NAICS code 513322 (issued October 2000). The census data do not provide a more precise estimate of the number of firms that have employment of 1,500 or fewer employees; the largest category provided is "Firms with 1000 employees or more."

[91] *See* text of Notice above at paragraphs 21, 22, 25, 26, 30, 31, 32, 34, 35, 36, 39, 40, 41, 42, 45, and 46.

entities; (3) the use of performance, rather than design standards; and (4) an exemption from coverage of the rule, or any part thereof, for small entities."[92]

If the rules proposed in this notice are adopted, we believe they might have a significant economic impact on a substantial number of small entities. For an entity that chooses to manufacture or import equipment for the subject bands, the rules would impose costs for compliance with equipment technical requirements, such as incorporating a GPS receiver and database access capabilities into an unlicensed device to determine its location and which TV channels are vacant in an area, or incorporating an FM or TV receiver to detect the presence of channel availability data being transmitted in its area. However, the burdens for complying with the proposed rules would be the same for both large and small entities. Further, the proposals in this *Notice* are ultimately beneficial for both large and small entities. We cannot find electrical engineering alternatives that would achieve our goals while treating small entities differently. Nonetheless, we solicit comment on any alternatives commenters may wish to suggest for the purpose of facilitating the Commission's intention to minimize the compliance burden on smaller entities.

F. Federal Rules that May Duplicate, Overlap, or Conflict With the Proposed Rule

None.

[92] 5 U.S.C. § 603(c)(1) – (c)(4).

STATEMENT OF
CHAIRMAN MICHAEL K. POWELL

Re: Unlicensed Operation in the TV Broadcast Bands (ET Docket No. 04-186); Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHZ Band (ET Docket No. 02-380), Notice of Proposed Rule Making

We continue to examine ways to advance broadband deployment and further the goal of universal access. Today's Notice of Proposed Rulemaking proposes a smart solution that would expand the availability of spectrum for new advanced and innovative services.

The Commission takes a hard look at the use of unlicensed devices operating on unused broadcast television spectrum in conjunction with smart radio technology. This technology has the potential to provide greater service to the American public. It promises to dramatically increase the availability and quality of wireless Internet connections - the equivalent of doubling the number of lanes on a congested highway.

Such technologies could create the same explosion in new business and growth that we have seen in the case of WiFi and Bluetooth. For instance, it could help bring high-speed Internet services to rural communities without the cables or wires. Existing broadcasters will also find benefits as they explore more advanced television services.

Our overarching goal in this proceeding is to find the most efficient and comprehensive use of the spectrum resource while not interfering with existing services.

The proposals we adopt today are balanced and take into account the competing needs of all affected spectrum users. They ensure the most efficient spectrum use; protect broadcasters and other authorized users in TV bands from harmful interference, and accords appropriate deference to the ongoing DTV transition.

STATEMENT OF
COMMISSIONER MICHAEL J. COPPS

Re: Unlicensed Operation in the TV Broadcast Bands (ET Docket No. 04-186); Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHZ Band (ET Docket No. 02-380), Notice of Proposed Rule Making

I'm please that we are exploring ways of finding spectrum below 1 GHz for unlicensed technologies. The unlicensed community has requested that we find such spectrum for many years now, explaining that with it they could bring broadband to communities where it is unavailable today, and maybe even bring new competition to a market that today is characterized by inadequate competition.

As we proceed, we must of course find ways to balance the need to provide spectrum resources for innovators, entrepreneurs, and new technologies with the equally important need to avoid harmful interference to incumbent users and consumers. I believe that this NPRM asks the right questions and that it is a balanced – and actually I think a rather conservative – approach, and I hope that broadcasters and unlicensed entrepreneurs alike will work with us to craft appropriate protections as we move ahead to realize the potential benefits of unlicensed use of this part of the spectrum.

Finally, I want to encourage the Bureau and my colleagues to be vigilant to ensure that we have the investigative and enforcement resources and plans in place as we pursue more and more complicated spectrum arrangements. We may allow unlicensed operations in this band. And we have already allowed other tightly packed licensed and unlicensed use in other bands. Given the interference concerns these actions create, we must be able and ready to conduct independent harmful interference tests, and to act decisively when harmful interference has occurred.

Thanks to OET for this good item.

CONCURRING STATEMENT OF
COMMISSIONER KEVIN J. MARTIN

Re: Unlicensed Operation in the TV Broadcast Bands (ET Docket No. 04-186); Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHZ Band (ET Docket No. 02-380), Notice of Proposed Rule Making

While I am pleased that this proceeding has the potential to encourage new and innovative unlicensed services, I remain concerned about the proceeding's impact on the broadcasters and their transition to digital television. *See* Separate Statement of Commissioner Kevin J. Martin, *Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band,* Notice of Inquiry, ET Docket No. 02-380 (Dec. 11, 2002). Accordingly, I concur in this item.

STATEMENT OF
COMMISSIONER JONATHAN S. ADELSTEIN

Re: Unlicensed Operation in the TV Broadcast Bands (ET Docket No. 04-186); Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHZ Band (ET Docket No. 02-380), Notice of Proposed Rule Making

At last year's rural WISP forum, I heard the call for more unlicensed spectrum from operators around rural America. They wanted more power and more capacity to drive broadband deployment deeper and farther into all corners of the country. I support today's item because it looks creatively at methods to accommodate unlicensed operations in vacant TV bands, a portion of the spectrum that has such favorable propagation characteristics for wireless broadband services. In this item we are rightly exploring the latest and most exciting cognitive radios and spectrum sensing techniques that are available to see ho they can enable spectrum facilitation in the TV bands.

Broadcasters have used public spectrum for many years to serve rural and urban areas alike in providing news, civic information, education and entertainment. Unlicensed operations should not be permitted in the television bands if they appear to be likely to cause harmful interference to TV reception, and I fully support our request for comment on how best to ensure that such interference is not caused by the operation of unlicensed devices. The American people care a lot about the quality of their television reception. Television broadcasts are viewed by people as perhaps the most sacred use of public spectrum. Their TV is not to be trifled with. We will hear an earful from consumers if this is not done right.

Finally, it is worrisome that we are undertaking this proceeding right in the middle of our important digital television transition. I have lingering concerns about the wisdom of allowing unlicensed operations in the vacant television bands before the DTV transition is complete, and I encourage commenters to fully address this timing issue and any problems that it creates.