

**Before the  
FEDERAL COMMUNICATIONS COMMISSION  
Washington, DC 20554**

In the Matter of	)	
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	Docket No. 12-268
	)	
	)	
Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band	)	WT Docket No. 08-166
	)	
	)	
Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition	)	WT Docket No. 08-167
	)	
	)	
Amendment of Parts 15, 74 and 90 of the Commission’s Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones	)	ET Docket No. 10-24
	)	

**COMMENTS OF ROBERT BOSCH LLC**

Robert Bosch LLC (“Bosch”)<sup>1</sup> respectfully submits these Comments<sup>2</sup> in response to (1) the Commission’s *Notice of Proposed Rulemaking* in the above-captioned Docket 12-268 proceeding addressing incentive auctions in the television broadcast band;<sup>3</sup> and (2) the

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<sup>1</sup> Bosch is a member of the Bosch Group of companies. The Bosch Group is a leading global supplier of technology and services, including safety and security systems. Among Bosch’s products marketed and used in the United States are wireless microphone and wireless intercom systems using channels in the UHF television band. These products are used in major sporting events and in other contexts. Bosch wireless intercoms are used by nuclear power generating facilities as a critical tool in refueling and other plant operations. Bosch produces wireless microphone and wireless intercom products under the brand names Electrovoice, RTS, Telex, and Radiocom.

<sup>2</sup> The Commission has twice extended the comment date in both open proceedings above. These comments are therefore timely filed. See, the *Order*, DA 12-1926 (rel. November 30, 2012, and the *Order*, DA 12-1916 (rel. November 29, 2012) and prior orders cited therein.

<sup>3</sup> See *Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, GN Docket No. 12-268 (rel. Oct. 2, 2012) (“*Incentive Auctions NPRM*”).

Commission's November 2, 2012 Public Notice<sup>4</sup> seeking comments in order to refresh the record with respect to the operation of wireless microphones and Low Power Auxiliary Service facilities (LPAS) in the television broadcast band. For the reasons set forth herein, Bosch principally requests that the Commission not retreat from the accommodations for continued operation of wireless microphones (WMs), wireless intercoms (WIs) and LPAS systems in the television broadcast band made very recently in the Commission's White Spaces proceeding.<sup>5</sup> Instead, in the best interests of the public, which relies heavily on the ability of broadcasters and video production companies to provide audio and video coverage of major news, sports and other events in real time, and in order to orchestrate and conduct sporting events and other entertainment productions, the Commission must protect ongoing WM, WI and LPAS operation and provide a reasonable period of time of not less than fifteen years for transition to more spectrum- efficient WM, WI and LPAS facilities (if, in fact, any regulatory incentives are necessary in this respect at all). To do otherwise will substantially disrupt the beneficial broadcast and other services to the public as they are now being provided and upon which the viewing public relies. For its comments in the proceedings captioned above, Bosch states as follows:

## **I. Introduction.**

1. In the *Incentive Auctions NPRM*, the Commission recognized that the proposal to auction and repack the UHF TV bands may reduce the spectrum available in the TV bands for secondary use by licensed and unlicensed wireless microphones, wireless intercoms and LPAS

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<sup>4</sup> See FCC Public Notice, *The Wireless Microphones Proceeding, Comment Deadlines Established*, DA 12-1763 (rel. Nov. 2, 2012). See also 77 Fed. Reg. 64446 (Oct. 22, 2012) ("Public Notice").

<sup>5</sup> *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, Second Memorandum Opinion and Order, 25 FCC Rcd 18661 (2010) (the White Spaces Docket). See also *Unlicensed Operation in the TV Broadcast Bands*, ET Docket No. 04-186, Third Memorandum Opinion and Order, 27 FCC Rcd 3692 (2012).

systems. The auction and repacking process will as well reduce the spectrum available for unlicensed White Space devices.<sup>6</sup> In that proceeding, the Commission seeks comment on, among other things, a number of issues aimed at promoting the efficient and effective operation of wireless microphones and wireless intercoms in the TV broadcast spectrum, thus to facilitate the auction of spectrum for broadband purposes in the band 470-698 MHz.<sup>7</sup> Correspondingly, the Public Notice seeks to “refresh the record” on two primary topics related to wireless microphones: (1) whether license eligibility should be expanded for certain categories of Part 74 wireless microphone and wireless intercom users; and (2) what steps the Commission should take to promote more efficient use of spectrum by wireless microphones and wireless intercoms. There are numerous aspects of these two proceedings (with respect to WMs, WIs and LPAS systems) that are interrelated. In the Public Notice, the Commission states: “We ask that these comments take into consideration recent industry developments, including advances in wireless microphone technologies, *as well as related Commission proceedings that affect use of wireless microphones, including the TV White Spaces proceeding and the Incentive Auctions proceeding proposing auction of spectrum currently allocated to television broadcasting.*”<sup>8</sup> In the *Incentive Auctions NPRM*, the Commission noted that it intended to issue a public notice to refresh the record on expanding eligibility for licensed operations to specified classes of users, and on improved efficiency standards.<sup>9</sup> The Public Notice was then issued raising both of those issues.

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<sup>6</sup> *Incentive Auctions NPRM*, at ¶¶ 221-239.

<sup>7</sup> *Incentive Auctions NPRM*, at ¶¶ 215-26.

<sup>8</sup> Public Notice, at 64,446-47 (emphasis added).

<sup>9</sup> *See Incentive Auctions NPRM*, ¶ 224 n.354.

## II. Background.

2. The timing of the release of the Public Notice and the *Incentive Auctions NPRM* have created substantial difficulties for manufacturers of products for electronic news gathering (ENG); for video production of sporting and other entertainment events; and for the organization and conduct<sup>10</sup> of those same televised events. The proposals in the instant proceedings come on the heels of a series of recent Commission actions which have heretofore, alone and cumulatively, had an exceptionally significant adverse effect on the availability of spectrum for wireless microphones, low power auxiliary service devices, and wireless intercom systems. Without any practical opportunity thus far to adapt to *those* changes, the Commission has now changed the plan for wireless microphones entirely, and in the process has eliminated all certainty about the ability to conduct broadcast, cablecast or satellite broadcasts of urgent news, and sports and entertainment programming, or the sporting and entertainment events themselves, due to a completely inadequate amount of spectrum reserved for these devices.

3. On January 14, 2010, the Commission adopted a *Report and Order and Further Notice of Proposed Rule Making (Wireless Microphone R&O/FNPRM)* addressing the rules for wireless microphones, wireless intercoms and other low power auxiliary devices that operate in the TV bands.<sup>11</sup> In that proceeding, the Commission prohibited the manufacture, import, sale, lease, offer for sale or lease, or shipment of wireless microphones and other low power auxiliary stations intended for use in the 700 MHz Band (TV channels 52-69, 698-806 MHz) in the United

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<sup>10</sup> For example, Bosch provides the wireless intercom system used during televised NFL football games for coach-to-coach communications between the coaches on the field and the coaching staff in the “coach’s box.” This system is, used pursuant to an LPAS Part 74 license held by the National Football League. The system uses a series of WM channels that are critical to the high noise environment and are relied upon by the football coaches for both teams during NFL games who cannot easily or safely return to the use of wired headsets during the games.

<sup>11</sup> See *Report and Order and Further Notice of Proposed Rule Making* in WT Docket Nos. 08-166 and 08-167 and ET Docket No. 10-24, 25 FCC Rcd 643 (2010).

States. It was required that all LPAS facilities, including WMs and WIs<sup>12</sup> cease operations in the 700 MHz band no later than June 12, 2010. The Commission acknowledged that WMs are used for important functions, and noted that many WMs were being operated by (non-broadcast) entities and persons ineligible for a Part 74 license. Therefore, along with the migration of full-power TV stations, Class A TV stations, TV translators, TV boosters and Low-power TV stations to available channels below 698 MHz, in the “core” TV channels, LPAS devices, WIs and WMs had to migrate downward as well.”<sup>13</sup> This greatly reduced the number of channels available for WM, WI and LPAS operation, and the downward migration was completed less than three years ago. A very large number of WMs and WIs were operating in the 700 MHz band and that equipment had to be modified or replaced with equipment that was not capable of operation above 698 MHz. This has put a significant burden on manufacturers of this equipment, and Bosch’s research and development efforts have since that time been aimed at compliance with the new provisions for operation of WMs and WIs in the core TV channels.

4. Meanwhile, at the low end of the UHF TV band, channels 14-20 (470-512 MHz) are used in thirteen major markets in the United States for important land mobile radio communications. That band is fully deployed for that purpose in those markets. There is a plethora of additional uses made of the television broadcast band. As noted in the *Second Memorandum Opinion and Order* in the White Spaces Docket at ¶ 8:

In addition, medical telemetry equipment is permitted to operate on an unlicensed basis on any vacant TV channel in the range of channels 7-46, and unlicensed remote control devices are allowed to operate on any TV channel above 70 MHz (*i.e.*, above channel 4), except for channel 37. TV channel 37 (608-614 MHz) is allocated for radio astronomy and the wireless medical telemetry service (WMTS) and is not used for TV broadcasting. The Offshore Radiotelephone Service uses channels 15-17 in

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<sup>12</sup> Low power auxiliary stations are short-path transmit devices. They are, in addition to wireless microphones and wireless intercoms, used for purposes such as cue and control communications, and synchronization of TV camera signals. 47 C.F.R. § 74.801 *et seq.*

<sup>13</sup> TV channels 2-51, excluding channel 37.

certain regions along the Gulf of Mexico...

(footnotes omitted)

The compression of all of these uses into the band 470-698 MHz, plus the Commission's very recent addition of TV White Spaces Devices (TVBDs) to the mix, and the accommodation of unlicensed WM users in that same spectrum has made operation of WMs, WIs and LPAS devices exceptionally difficult, despite real-time channel sharing procedures utilized at major events. The concept of "TV White Spaces", long a misnomer (because there never really were any) became, after the 2010 White Spaces proceeding, a very inapplicable label indeed.

5. Yet, the Commission did, as recently as September of 2010, provide at least some protection for WMs, WIs and LPAS devices. In the *Second Memorandum Opinion and Order* in the White Spaces Docket, at ¶ 29, the Commission stated that it "continue[s] to recognize that wireless microphones are currently used in many different venues where people gather for events large and small and many consumers and businesses have come to rely on these devices." Specifically for the purpose of accommodating WMs and WIs after the reallocation of the 700 MHz band, the Commission noted that it had previously limited use of TV channels 2 and 5-20 to communications between fixed TVBDs, and it had also previously reserved two channels in the range 14-51 in the 13 markets where PLMRS and CMRS systems operate "to make sure that frequencies are available for wireless microphones."<sup>14</sup> Most importantly, the Commission held in September of 2010 that it was "...*expanding the reservation of two channels in the range 14-51 to all markets nationwide as suggested by several petitioners. This will provide frequencies where a limited but substantial number of wireless microphones can be operated on any basis without the potential for interference from TV bands devices. It will also ensure that frequencies*

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<sup>14</sup> See *Second Report and Order*, 23 FCC Rcd 16860 (2008) at ¶ 151. With regard to channels 2 and 5-20, the Commission stated that restricting use of channels 2 and 5-20 to communications by fixed devices with other fixed devices would limit the number of TVBDs that could potentially conflict with wireless microphone use.

are available everywhere for licensed wireless microphones used on a roving basis to operate without risk of receiving harmful interference from TVBDs.”<sup>15</sup> The Commission also provided for a nominal separation distance between TVBDs and sites of venues and events where large numbers of unlicensed wireless microphones are used by permitting such sites to be registered in the TV bands databases. It noted that, at any particular location, a number of TV channels would not be available for TVBDs due to the application of the various interference protection requirements under the rules. Therefore, the Commission concluded, “a significant amount of spectrum will be available on which wireless microphones can be operated as they have in the past without concern for interference from TVBDs. We believe that this spectrum will provide sufficient frequencies to support wireless microphone operations at the great majority of events.” Because of these accommodations, *and specifically because of the reservation of the two channels per market for WM, WI and LPAS operation*,<sup>16</sup> broadcasters, televised sporting event sponsors and video production companies were confident that they could continue to conduct ENG, televised major event organization communications, and event video production activities as necessary. Broadcasters and others have, since late 2010, invested heavily in wireless microphones and wireless intercom systems that will operate near TV channel 37 because of the location of the reserved channels. This investment was precisely in reliance on the 2010 White Spaces *Second Memorandum Opinion and Order*.

6. The Commission’s accommodation for WMs in the TV White Spaces Docket was no panacea. As the Commission has acknowledged,<sup>17</sup> there is at any given news, sports or

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<sup>15</sup> *Second Memorandum Opinion and Order*, 25 FCC Rcd 18661 at 18674 (2010).

<sup>16</sup> See, 47 C.F.R. §15.707(a) (prohibiting white space devices on the first channel above and the first channel below channel 37 that are available, or if a channel is not available above and below channel 37, prohibiting white space devices on the first two channels nearest to channel 37).

<sup>17</sup> A good primer on WM and LPAS use of UHF television broadcast bands was provided at paragraph 223 of the *Incentive Auctions NPRM*. The Commission stated that:

entertainment event the need for more than 100 WMs and LPAS devices.<sup>18</sup> Because, in a given broadcast market there are many unlicensed WMs and WIs as well as licensed WMs, and because the Commission has not limited the reserved channels in a given market to only licensed WMs, not all of the two reserved channels can be used in any given market. Notwithstanding, the Commission in September of 2010 refused to provide any additional spectrum for WMs, saying that:

We disagree with those who argue that more spectrum should be reserved for wireless microphones. We observe that wireless microphones generally have operated very inefficiently, perhaps in part due to the luxury of having access to a wealth of spectrum. While there may be users that believe they need access to more spectrum to accommodate more wireless microphones, we find that any such needs must be accommodated through improvements in spectrum efficiency.

It is true that, because of the need for broadcast-quality audio for broadcast applications, and for use of WMs and WIs in theatrical and sports productions, WMs have historically required almost 200 kilohertz of occupied bandwidth. While the next generations of WMs may have slightly

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Licensed LPAS may operate on vacant channels allocated to television broadcasting. In the UHF band, co-channel LPAS operations must be separated by a distance of at least 113 kilometers (70 miles) from the television station. Unlicensed wireless microphones are permitted similar types of operations on this unused spectrum. Wireless microphones operate in a relatively narrow bandwidth and often are technically capable of choosing different frequencies among multiple vacant channels available for operation. Many wireless microphones are used regularly and predictably (*e.g.*, at television studios, movie studio lots, or major sporting events facilities), but at times the location of their operation changes (*e.g.*, covering news events in different places). The nature of wireless microphones and their use is such that they operate for relatively short intervals at different times, and the specific frequencies they use for operation often change, even when used at one location. Theatrical and sports productions and other major events often use more than 100 wireless microphones, which in certain locations could use most if not all of the UHF channels available to them in the television bands.

<sup>18</sup> At the largest sporting events and at political conventions, there are typically more than 120 WMs and LPAS devices in use, often simultaneously. For example, at a recent Formula One automobile race in Texas, held at a venue well away from the metropolitan area of Austin, Texas, there was an acute shortage of WM spectrum and well over 120 WMs were in use at any given time, due to the presence of non-U.S. broadcasters as well as local broadcast and video production entities. At the NFL Super Bowl each year, and during political conventions, extraordinary efforts are made to accommodate the number of WMs necessary to provide coverage of these events that the public expects, using a series of television broadcast channels. Event frequency coordinators are required at these events to make sure that the most efficient use is made of the limited amount of spectrum available now for WMs in real time. Should anything less than the current amount of WM spectrum be available in the near term, given the equipment now in the field, the public will be deprived of the ability to have these events brought to them as they are now.



more spectrum efficiency, this equipment is not now universally available. Furthermore, the equipment now on the market is not suitable for the types of applications that analog WMs and WIs have been used for. There are latency issues and issues relating to graceful failure with digital equipment that have yet to be solved, making the current generation of WMs and WIs critical to the real-time applications to which they are now put. Manufacturers of WMs and WIs including Bosch have a very substantial investment in research and development in the current generation of WMs. Broadcast licensees (and churches, theaters, sports venues and video production entities, etc.) have a substantial investment in purchased equipment with a very long usable life. There is a large base of embedded equipment which has very recently been acquired by licensed and unlicensed WM and WI users in reliance on the continuation of the accommodations created in the White Spaces Docket, in particular the two reserved channels per market with no TVBDs permitted on them.

7. In addition to the “reserved” TV channels (which vary by market) for general daily operation, the Commission created the very new geolocation database registration arrangement for operations that exceed the spectrum available through the two reserved channels at given venues. WM and WI users, licensed and unlicensed, are just now able to make use of these databases to ensure that their WM/WI use can continue without interference from TVBDs. The Public Notice announcing final implementation of the database was released as late as March 26, 2012,<sup>19</sup> and the Notice regarding special, complex procedural rules for use by unlicensed parties was released on September 19, 2012, about four months ago. It was not until December 6, 2012, just over a month ago, that the registration system for unlicensed WMs was made available on a nationwide basis. Only now are major event/production venues across the country able to

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<sup>19</sup> FCC Public Notice, *Office of Engineering and Technology Announces the Approval of Telcordia Technologies, Inc.’s TV Bands Database System for Operation*, DA 12-466 (rel. Mar. 26, 2012).

register with the TV bands white space database systems so that operations of unlicensed WMs and LPAS devices at specified times will be protected from potential interference caused by TVBDs.

8. A large number of WM users are unlicensed. They are non-technical users and have no idea of the complexity of the arrangements made in 2010 for their continued use of WMs going forward. Unlicensed WM users (due to a lack of familiarity with their regulatory obligations or entitlements in the use of WMs) have a very high learning curve and a very low level of compliance with respect to the Commission's rules. It will take a long time to change established operating patterns and for these users to adapt to any radical regulatory changes such as would be necessitated by the *Incentive Auctions NPRM*, notwithstanding the best efforts of Bosch and other manufacturers to instruct and caution their unlicensed customers about regulatory obligations.

9. The Public Notice *and Incentive Auctions NPRM* propose a radical change of direction for WM and LPAS operations. Broadcasters, video production companies, manufacturers and representatives of unlicensed WM users have had very little time to accommodate the Commission's most recent changes stemming from the White Spaces proceeding. Any further erosion of the availability of spectrum for WM and LPAS operation will severely limit, if not preclude, real-time ENG and news, sports and entertainment programming and the conduct of the events themselves. The Commission's zeal to auction the television broadcast bands must be tempered by the reality that WM/WI technology is deeply embedded in the TV broadcast bands now and for the foreseeable future. The issues raised in the Public Notice are less of a concern than are the very radical (and unworkable) proposals for WMs and WIs in the *Incentive Auctions NPRM*. In effect, there is *no* proposal in that proceeding for accommodating wireless

microphone or wireless intercom operations due to the overall reduction of available UHF spectrum for unlicensed and LPAS use.<sup>20</sup>

### **III. The Commission Should Ensure That The Reconfigured UHF Television Broadcast Band Has At Least 24 MHz per Market Available for WM Operation.**

10. The *Incentive Auctions NPRM* represents a sharp departure from the TV White Spaces Docket in terms of accommodation of WMs and LPAS devices in the UHF television band. The Commission stated at paragraph 224 of the *Incentive Auctions NPRM*:

The repacking of television stations may result in a reduced amount of spectrum being available in the core television bands for use on a secondary basis by licensed wireless microphones under the LPAS rules and for use by unlicensed wireless microphone operations. At the same time...with the proposed creation of guard bands for new uses some spectrum may be newly available for unlicensed use, including wireless microphones that can use the technologies required for white space device operations in the guard bands. We seek comment on what steps we should take, if any, to best accommodate wireless microphone operations along with other uses, as well as to ensure that the available spectrum is used efficiently and effectively by wireless microphones. We seek comment with respect to both licensed LPAS and unlicensed operations.

In short, the NPRM constitutes, to a great extent, a proposed abandonment of the accommodations made in 2010 for WMs and LPAS devices. Notably absent from any of the proposals in the NPRM is any accommodation specifically for *licensed* WMs or WIs. The NPRM proposes to delete the two reserved channels for WMs near Channel 37. Depending on the outcome of the incentive auction, there may be no channel available for WM operation in a given market which is not shared with TVBDs, and no channels where unlicensed WMs would be excluded. The Commission makes no proposal for any reaccommodation spectrum for any WMs or WIs elsewhere, having noted earlier that there is generally no replacement spectrum offered for displaced secondary users in reallocated spectrum. It does, however, ask at ¶ 225 of

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<sup>20</sup> *Incentive Auctions NPRM*, ¶ 224. Nor is VHF spectrum a viable substitute for UHF WM operation. The Commission has acknowledged that there is very little professional quality equipment available for use in TV channels 2-13.

the *Incentive Auctions NPRM* what can be done to promote more “efficient or effective” operation of WMs in this spectrum:

In particular, we seek comment on the operations of wireless microphones in the repacked spectrum that continues to be used for broadcast television service. With less broadcast television spectrum available after the repacking, and the possibility that two channels may no longer be designated for wireless microphone use, are there additional steps that we should take to promote more efficient or effective operations of wireless microphones in this spectrum? For instance, to make more of this limited spectrum usable for wireless microphones, should the Commission revise the rules for operating these devices on a co-channel basis with television stations in the UHF band by reducing the separation distance of 113 kilometers, a requirement established prior to the transition to digital television? Apart from reducing the separation distances generally, are there other, more precise methods that we should consider, such as permitting co-channel wireless microphone use even closer to television stations through use of a database that takes into account the particular interference conditions at that location?

Bosch’s experience shows that a minimum of 24 MHz of spectrum should be available for WMs in each market. This number could be reduced over time, as WM technology evolves, but the Commission should not equate narrow occupied bandwidth with increased spectrum efficiency in WM and WI technology.<sup>21</sup> WM and WI equipment that is suitable for many news, sports and entertainment applications is not now available. Even if it was, it would be unreasonable for the Commission to mandate a short-term conversion of WM technology to digital emissions or some technology viewed as more spectrum-efficient. The Commission has, in the radical changes proposed now, and in its proposal to abandon the minimal accommodations adopted in the 2010 White Spaces proceeding, created in effect a “bait and switch” situation in less than two years.

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<sup>21</sup> This is a very important distinction. The NPRM suggests that WM technology is spectrum-inefficient. The trend in wireless microphone and intercom design to maximize spectrum efficiency, however, is *not* aimed at reduction of occupied bandwidth. Quite the contrary: Most of the newer designs actually occupy more bandwidth per channel than do earlier-generation designs. Most digital wireless microphones fully occupy a 200 kHz channel. They do, however, allow the use of more channels in a given band by controlling intermodulation and power. There are narrow-bandwidth wireless products now on the market that occupy less bandwidth, but that technology is not suitable for wireless microphone use. Therefore, the overall amount of spectrum needed for wireless microphone and wireless intercom technology will not diminish in the near term, notwithstanding the ongoing digital WM and WI technology conversion.

Broadcasters, televised event sponsors and video production companies have very recently invested substantially in current generation equipment in reliance on the availability of the two reserved channels. If there are insufficient channels available for WMs, WIs and LPAS devices after the incentive auctions, the database registry for WM venues to be protected from TVBDs will become moot. Furthermore, if there are no channels reserved for WMs and LPAS devices which are not to be shared with TVBDs, WM users, and especially broadcasters, sports and event sponsors and video production entities simply cannot provide interference-free service to the viewers and audiences that expect the same and receive it now.

11. The only proposal in the NPRM that would offer any accommodation at all for WMs is apparently to allow WMs, WIs, LPAS devices and TVBDs to operate in the two guard bands (Channel 37 and the lower adjacent of the lower uplink/downlink wireless segments to be auctioned). This is a seriously inadequate and insufficient accommodation for WM/WI operation. From the perspective of television broadcasters, it offers them no ability at all to cover breaking news and to cover sports and other events in real time, or for producers of sporting events such as the NFL who have to have uninterrupted access to enough spectrum in a given venue to conduct the event and televise it. *It is critical for these reasons that there be at least two reserved channels, totaling at least 12 MHz, exclusively for WM operation.* WM operation on guard bands, shared with TVBDs, would not provide the opportunity to produce and televise these events.

12. At the same time, there is a need for the foreseeable future to have available for video production of news, sports and entertainment events -- regardless of the means of multicasting those events to the viewing public -- a total of at least 24 MHz of spectrum available. This would

provide a total of approximately 60 usable channels<sup>22</sup> for WM operation, albeit only 12 of which would be on reserved channels on which TVBDs would be excluded. However, provided that the registration database is available on a nationwide basis, enough spectrum would be available to accommodate major news, sports and entertainment broadcasting as it is being done now in a given broadcast market. In order to aggregate 24 MHz of spectrum for WMs in each market, Bosch suggests that the Commission preserve the concept of two channels near Channel 37 (unless the Commission relocates whatever Radioastronomy is still ongoing in the 608-614 MHz band, in which case Channel 37 could be one of the two reserved channels in each market) and as well permit WM/WI operation in each of the two proposed “guard bands” provided that those guard bands are at least six megahertz wide each. Bosch manufactures many models of full duplex, frequency division wireless intercom products. These devices require uplink and downlink frequency separation as do the broadband devices that will occupy the UHF television broadcast band. Of the 24 MHz of spectrum minimally necessary for WM and WI operation, WIs require two bands of 12 MHz each, separated by approximately 70 MHz. WMs would benefit from this configuration as well. Notwithstanding the duplex channel configuration requirement, the segments need not be contiguous, as is the case with cellular telephones. Rather, the necessary 24 MHz would comprise separate, noncontiguous, 6 MHz channels.<sup>23</sup>

13. As noted above, over time, it would be reasonable to pare down this 24 MHz of

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<sup>22</sup> Current analog wireless microphone technology allows a maximum of 20 simultaneous wireless microphones to operate in the same geographic area at a time in a total of 24 MHz. The newest techniques cited by Shure and others claim to permit 15 WMs per 6 MHz (which extrapolates to 60 in 24 MHz). Even if the new technologies did permit that level of efficiency, 60 channels would not be sufficient for the production of major news, sporting and entertainment events as they are done now, which requires more than 100 channels per event.

<sup>23</sup> Bosch specifies herein a minimum of 24 MHz of WM and WI spectrum. A preferred configuration would be to create two separate, 24 MHz UHF bands, which would permit a total of approximately 120 WMs in a given venue. Realistically, however, and based on the Commission’s past firm refusal to make available more spectrum for WMs and WIs than it did in the White Spaces Second Memorandum Opinion and Order, it is apparent that this preferential configuration is not likely. A total of 24 MHz, however, including the two reserved channels totaling 12MHz, is critical, as discussed above.

spectrum for WMs in each market to something less, due to changed technology. Bosch would dispute the Commission's claim, however, that WM operation is presently "inefficient". The bandwidths used in the current generation of WMs, wireless intercoms and LPAS devices have been necessary for transmission of broadcast quality audio without latency. Theater and church use of WMs has necessitated high quality audio. The use of high-quality audio is necessary in safety situations such as the use of WIs at nuclear power facilities and in high noise environments such as sports arenas and stadiums. The current technology provides the type of audio that certain audiences have come to expect. It will be at least fifteen if not twenty years, however, before the current generation of WM equipment is retired and universally replaced by a next generation of equipment. Manufacturers such as Bosch require time to change their research and development plans and to amortize the costs thereof. The Land Mobile Radio Service is now in the midst of a two-part narrowbanding conversion in the VHF and UHF land mobile radio bands from 25 kHz technology to 12.5 kHz and, later, 6.25 kHz technology that first commenced well more than ten years ago. To do the same thing with respect to WMs, it is necessary to plan for and to allow a reasonable transition to more spectrum efficient technology over a period of years. Also as noted above, broadcasters and other users of WMs and WIs, in reliance on the Commission's 2010 plan for the availability of two reserved channels for WMs in each market, have made large expenditures for equipment that will function adequately for a long period of time. The Commission should not simply note that one or two manufacturers have on the market WM equipment that it believes to be spectrum efficient and use that as a rationale to adopt a band plan that will render unusable an entire generation of equipment, including other manufacturers' product lines and recently-purchased equipment held by broadcasters and other WM users, which is in daily, regular use.

#### **IV. Eligibility for Part 74 Licensing.**

14. The Public Notice asks about the possibility of expanding eligibility for Low Power Auxiliary licensing to include entities other than broadcast, cablecast, and motion picture and video production entities. Licensing offers some WM users who require interference protection some benefits. However, under current rules, unlicensed WMs are allowed to operate in the television broadcast band at slightly lower power levels than, and on a secondary basis to, licensed WM users. As discussed above, unlicensed WM users are non-technical entities typically. The Commission's database registration system permits large venues where licensed and unlicensed WMs can be protected against interference from TVBDs. The rules also provide that, even in these venues, unlicensed WMs must protect licensed WM operation. This is a reasonable paradigm for licensing, with but one exception.

15. The Public Notice asks whether or not nuclear power generating facilities should be permitted to be licensed to use wireless intercoms. The Commission has for years permitted nuclear power facilities to utilize these intercoms by temporary waiver and pursuant to experimental licenses. Since 2003, and by agreement among the National Association of Broadcasters, the Society of Broadcast Engineers, the former Association for Maximum Service Television, the Nuclear Energy Institute and the Utilities Telecom Council, cooperative arrangements have been made for nuclear power facilities to use wireless intercom equipment for communication among personnel for various purposes, including refueling operations, plant "outages" and in other circumstances. The wireless intercom equipment is presently the only equipment known to offer the requisite features and capabilities to allow plant workers to efficiently communicate and fulfill their obligations under the Nuclear Energy Commission's ("NRC") "ALARA" standard. The ALARA standard requires NRC licensees to make every



reasonable effort to maintain exposures to radiation as far below the NRC-established dose limits as is practical, consistent with the purpose for which the licensed activity is undertaken, taking into account the state of technology, the economics of improvements in relation to the benefits to the public health and safety, and other societal and socioeconomic considerations, in relation to the utilization of nuclear energy and licensed materials in the public interest. See, 10 C.F.R. § 20.1003 et seq. Although the equipment transmits on Part 74 frequencies for which the facilities are not eligible users, since 2003 the Commission has issued a series of Special Temporary Authorizations (“STAs”) to permit the facilities’ continued use of the equipment on Part 74 frequencies in order to accommodate the nuclear industry’s efforts to limit plant worker exposure to radiation.

16. Nuclear power facilities need this equipment for reliable telecommunications. The facilities have agreed to and do engage in local frequency coordination, and there have been no complaints of actual interference noted over a period of many years. The above-referenced entities forged in 2007 a consensus plan that was based on the Commission’s granting experimental licenses to each of the NRC-licensed nuclear plants. The use of wireless intercom equipment is on a secondary basis to all Part 73 and 74 broadcast licensees. It is used outdoors very infrequently during refueling operations outdoors, during outages, or in any potentially hazardous circumstances such as during radiological material handling. Most of the time, it is used within the shielded environment of the power facility which precludes almost all RF egress from the nuclear facility. The exceptionally low power used, and the location of most nuclear power facilities makes any interference to any user or proposed user of television broadcast spectrum highly unlikely.

17. Given this cooperative history, the absence of interference complaints, and the

compelling need shown for use of this equipment by nuclear power generating facilities, Bosch urges that nuclear power facilities be considered eligible for LPAS licenses, on a secondary basis to ENG operations by broadcasters and with the requirement that all operation be subject to prior frequency coordination as has been the case all along.

#### **V. More Efficient Wireless Microphone Operation Through Technical Advancements.**

18. As broadly discussed above, while digital wireless microphone technology may in the future allow for more efficient operation in terms of occupied bandwidth, this technology is still very new and has yet to be significantly embraced for a number of reasons. There are concerns about latency and graceful failure, which are not issues with analog WM/WI devices. Many broadcasters and other WM/WI users have made very recent, very significant investments in analog equipment in order to accommodate the clearing of the 700 MHz band, as required by the Commission. It will be quite a few years until this equipment is depreciated and/or subject to replacement. Doubtless, during this period, manufacturers of this equipment will gradually convert to digital technology and so will the WM consumers. Digital equipment will become more universally available, but as noted above, this will not at all lead to narrower occupied bandwidths. Under any circumstances, over at least the next fifteen to twenty years, any regulatory transition to more spectrum efficient technology and any reduction in total available spectrum for WMs and WIs will have to be permitted on a gradual, rather than a “flash cut” basis.

#### **VI. Conclusions.**

19. The Commission has placed broadcasters, manufacturers, and other users of licensed and unlicensed WM, wireless intercom and LPAS devices in a very difficult position following the clearing of the 700 MHz band and the 2010 accommodations made for TVBDs in

the UHF television band. Having just now started to adjust to this process, and having made very substantial investments in UHF wireless microphone equipment and R&D for the same, these same entities are being asked why the very few provisions made for continued use of WMs in the band between 512 MHz and 698 MHz should not be scrapped entirely, and replaced with a very uncertain RF environment that may or may not accommodate them at all, post-incentive auction. The Commission should not retreat from the provisions made in 2010 for continued ENG and news coverage operations by broadcasters; and for broadcast and cablecast and the coordination of major news, sports and entertainment events in real time. While over a period of several years, the Commission may mandate some form of spectrum efficiency for licensed and unlicensed WMs, this cannot be done on any short term basis and it will not necessarily result in a reduction in the need for a total amount of spectrum approaching 24 MHz in each market. Bosch suggests that a period of twenty years might be appropriate for any technology conversion process in any case. In the interim, it will be necessary for the Commission to provide an assured minimum of 24 MHz of spectrum in each market that will be available for licensed and unlicensed WMs and WIs. Of this, 12 megahertz must be exclusive and not subject to TVBD operation. The remainder can be in guard bands or wherever the Commission finds suitable.

20. In terms of eligibility for licensing, Bosch has no specific objection to expanding Part 74 Low-Power Broadcast Auxiliary Service eligibility to include major event venues such as large churches, large theaters, sports arenas, race tracks and concert halls, but it is necessary to entitle nuclear power generating facilities to become LPAS licensees. The licensing process will have the benefit of providing a basis for protection of the WI communications at the nuclear facility and at the same time protect broadcast ENG operations under any circumstances.

Accordingly, for good cause shown, Bosch urges the Commission to take action in the

Incentive Auction Proceeding and in the Wireless Microphone docket only in accordance with these comments and not otherwise.

Respectfully submitted,

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