

Before the
FEDERAL COMMUNICATIONS COMMISSION
Washington D.C. 20554

In the matter of:)
)
Additional Spectrum for Unlicensed Devices) ET Docket No. 02-380
Below 900 MHz and in the 3 GHz Band)
)

REPLY COMMENTS OF

Shure Incorporated

Shure Incorporated ("Shure") hereby files these brief Reply Comments to the Notice of Inquiry ("NOI") in the above-captioned matter.¹ In its initial comments, Shure vigorously opposed the proposed use of the TV band by unlicensed devices based on the unacceptable interference that would be caused to existing users. These include Low Power Auxiliary Stations ("LPAS"), such as wireless microphones that are licensed secondary users of the television spectrum operating under the provisions of Section 74.861 of the Commission's Rules, 47 C.F.R. 74.861. As previously noted by Shure (and by other parties), the American public relies upon these devices, either directly or indirectly, for the production of virtually all news, sports, and entertainment programming on the air today. Their operation would be impossible without diligent frequency coordination, especially given the scarce availability of open channels within the television bands. While some parties have displayed enthusiasm for permitting an unknown variety and number of unlicensed operations to expand into the TV bands, the majority of parties recognize that such expansion would cause unacceptable interference to existing users. No commenting party persuasively explained how the proposed unlicensed operations could coexist with existing users without, at best,

¹ *Additional Spectrum for Unlicensed Devices Below 900 MHz and in the 3 GHz Band*, Notice of Inquiry, ET Docket No. 02-380 (rel. Dec. 20, 2002) ("Additional Spectrum NOI").

intermittent and unpredictable harmful interference. It is fallacious to argue that an unlimited number of new unlicensed devices could be “shoehorned” into the overcrowded television bands without having a devastating effect on both domestic television reception and LPAS operation.

Statement of Interest

Shure is a respected manufacturer of professional wireless audio products that operate within the 470-806 MHz band under Section 74.861 of the Commission's Rules, 47 C.F.R. § 74.861, as Low Power Auxiliary Stations (“LPAS”). As such, Shure is well-qualified to comment on the LPAS issues raised in this proceeding. Shure holds Grants of Equipment Authorization (Certifications) from the Federal Communications Commission (“FCC”) for these products. Shure has also participated in previous Commission actions involving LPAS devices, as well as the current proceeding.²

I. Unlicensed devices will adversely impact the known, stable interference environment required for Low Power Auxiliary Stations to operate successfully

LPAS require a known, stable interference environment in order to operate successfully. LPAS transmitters are able to share the broadcast spectrum successfully by operating on discrete frequencies. But, sharing often requires the help of frequency coordinators to prevent interference between wireless audio system users. At large public events, such as the Super Bowl, frequency coordinators are assigned to help prevent interference between wireless audio system users that may number in the hundreds. If the Commission allowed a multitude of unlicensed devices to operate in the TV band with a “listen before talk” protocol, wireless microphone operation would be devastated. Wireless microphones and other secondary licensed devices do not have

² See, e.g., *Reallocation of TV Channels 60-69, the 746-806 MHz Band*, Comments of Shure Brothers Incorporated, ET Docket No. 97-157 (filed Sept. 11, 1997); *Service Rules for the 746-764 and 776-794 MHz Bands and Revision to Part 27 of the Commission's Rules*, Comments of Shure Brothers Incorporated, WT Docket No. 99-168 (filed July 16, 1999); *Broadcast Auxiliary*

“defined protection contours” like TV stations.³ Shure agrees with commenters that it is hard to identify unused spectrum because of these devices, but additionally points out that it is even more difficult to protect these secondary licensed users from interference with a “listen before talk” protocol.⁴

To understand why, it is necessary to have a working knowledge of how these systems are used. For instance, before a production, most frequency coordinators do a site survey of available frequencies with a spectrum analyzer. They then coordinate the operation of the various wireless microphones and other systems to use frequencies that will not interfere with each other. This is not a simple task, especially when there are 50 or more transmitters operating at close range on a stage. After the frequencies have been chosen, all of the equipment has to be physically set up. Once this has been done, transmitters are often turned off to conserve battery power until they are needed.

Shure’s initial comments explained why the Commission cannot rely on proposed “listen before talk” and frequency agility techniques to prevent unlicensed devices from causing harmful interference to existing TV band users. In short, these “*ad hoc*” approaches to frequency interference management are inadequate safeguards for situations where the existing users are operating pursuant to a carefully crafted frequency plan developed for a particular site and where the licensed use is such that even intermittent, unpredictable interference can effectively render the licensed operation useless for its intended purpose. If an “opportunistic” unlicensed transmitter was introduced into this environment and it subsequently grabbed an “unused” channel, that *ad hoc* unlicensed operation would invalidate the frequency coordination plan

Service Rules in Part 74, Reply Comments of Shure Incorporated, ET Docket No. 01-75 (filed Aug. 7, 2001).

³ See, *Additional Spectrum NOI*, Comments by the Association for Maximum Service Television, Inc., *et. al.*, at p. 16 (filed April 17, 2003) (“MSTV comments”).

⁴ *Id.*, see also, *Additional Spectrum NOI*, Comments by Motorola, Inc., at p. 4-5 (filed April 17, 2003).

developed for that site. In most cases, there would be insufficient time to change frequencies before the production began. Often when one frequency has to be changed, others may require changing as well. Sometimes, an unexpected change in one part of a frequency interference plan will render the entire frequency coordination plan unworkable. It is important to note that most new unlicensed devices, such as wireless LANs, are wideband emitters; thus, it is more than likely that if they cause interference to one wireless microphone, they will disrupt operation on other frequencies as well. Additionally, even if a new plan can be developed, transmitters and receivers must also be physically retuned to new frequencies. Accordingly, in most cases it will not be practical for a wireless microphone user to recoordinate and implement a new frequency plan on the spot to accommodate interference generated by unlicensed devices. A situation like this could potentially shut down an important event. Furthermore, as suggested in the MSTV comments,⁵ Shure emphasizes that a “listen before talk” protocol would not significantly protect secondary users, and it will likely increase the costs of unlicensed devices, which could potentially cause manufacturers to “cut corners” and offer even less protection.

Wireless Audio Video Devices (WAVDs) can also cause major problems for wireless microphones. A single WAVD transmitter takes up an entire 6 MHz-wide TV channel, which can be a major issue for other spectrum users in an area like Los Angeles where there may initially be only a few “open” TV channels available. Contrary to the comments of New America Foundation,⁶ WAVD operation is not an example of how *unlicensed* devices can coexist well with wireless microphones for several reasons. First, WAVDs are required to be licensed. Second, they are required to be frequency

⁵ *MSTV Comments*, at p. 4-5.

⁶ *Additional Spectrum NOI*, Comments of New America Foundation, *et. al.*, at p. 14 (filed April 17, 2003).

coordinated. Third, WAVDs take up as much spectrum as eight or more conventional wireless microphone transmitters.

II. The transmission range of a wireless microphone is strongly affected by environmental factors, including interference from many potential sources

In comments filed with the Commission in this proceeding, it has been stated that a “wireless microphone can transmit up to 1,000 feet.”⁷ This is true under ideal conditions, such as outdoors over flat terrain, and in the absence of any interference. However, in practice, these distances are seldom achieved in a typical installation. Many factors can inhibit the useful range of a wireless microphone. First, for aesthetic and practical reasons, many use internal antennas, which can result in a sacrifice in efficiency. Absorption is also a factor, since wireless microphones are normally worn or held close to the body. Obstructions or reflections in the transmission path, particularly indoors, can weaken the signal. Finally, a wireless microphone transmitter operates at a very low power level—typically 10 to 50 mW maximum. Interference can easily overpower a wireless microphone or significantly reduce its range. For all of these reasons, wireless microphone systems must be set up using conservative frequency interference assumptions in order to remain well within the potential working range of the system and to prevent signal dropouts. Users (and audiences) expect wireless microphone operation to equal the sound quality of a wired microphone. Therefore, dropouts, interference, and noise are not tolerated in this context.

III. Radio waves do not necessarily adhere to a simplistic pattern of coverage or interference, and their transmissions are not strictly bounded

Radio waves do not know that they are supposed to ask permission before entering or leaving a building. Anyone who is old enough to remember when CB (“Citizens Band”) was popular will be familiar with how difficult it can be to control unwanted interference. This is why it is unrealistic to expect that one person’s choice to

allow an unlicensed LAN system to block their own TV reception will not impact their neighbors living in the apartment next door or downstairs.⁸

Some commenters suggest that TV reception interference problems could be solved by just moving the TV antenna a few degrees, such as could be done at the higher frequencies used for satellite TV.⁹ But, the fact is that at VHF and UHF frequencies, it takes a much larger antenna to have enough directionality to resolve interference in this way. This would be impractical with an indoor antenna.

It is true that radio signals can “pass through” each other without destroying the other signal,¹⁰ but it is not true that the resulting coverage or interference patterns are simple and easily predicted. This is especially the case for transmissions inside buildings or other reflective spaces. Interference zones, which are spaces where usable signals are not available either from a distant high power or nearby low power source, seldom behave in such a simple manner as two sets of ripples on a pond. Instead, the signal levels vary greatly due to reflections and absorption, sometimes within a few inches.

IV. Users of Wireless LANs and other unlicensed devices have no practical means of determining when they cause interference to a licensed service

It is inevitable that unlicensed devices using television band spectrum would end up being operated in close proximity to receivers such as television sets and wireless microphone systems. The indoor reception environment for analog TV is already a difficult one due to signal absorption and reflections. For DTV, the situation is even more problematic. If the DTV signal is too weak or suffers from excessive multipath interference, instead of impaired reception, there will be no reception at all. Additional noise from a forest of unlicensed transmitters would create an RF “smog” that would add

⁷ *Id.*, at p. 13.

⁸ *Id.*, at p. 17.

⁹ *Id.*, at p. 16, n.32.

considerably to this burden. Importantly, an unlicensed device that is blocking reception has no mechanism for determining whether it is causing the interference problem. It would be up to the user to experiment with antenna orientation and equipment position to see if a workable solution could be found. It is important to remember that most users are non-technical and have a very limited understanding of how wireless transmission works.

A wireless microphone user would be likely to encounter similar problems. In a live event situation, it would be very difficult to solve interference problems. This would be particularly true if certain factors such as the location or operating frequency of the interfering unlicensed system were not under the user's control.

CONCLUSIONS

There is no precedent that could be used to gauge the potential impact of the widespread deployment of millions of unlicensed transmitters within the television broadcast bands, despite suggestions to the contrary. Allowing unlicensed use would also involve a strong possibility of significant harm to the main communications infrastructure upon which every American citizen depends. At the same time, the potential benefit of allowing these unlicensed systems to operate in the television bands is small, particularly in the congested areas where such spectrum is most needed because very few "open" television channels actually exist. By contrast, higher frequency bands in the GHz range offer far more bandwidth and lower noise. They are also much better controlled, in terms of their transmission path, through the use of directional antennas. These "GHz" bands would be far better suited to the short range, wide band transmission needs of devices such as wireless LANs and "last mile" wireless Internet connections.

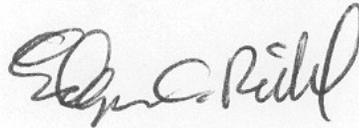
¹⁰ *Id.*, at p. 17, Figure 2.

For all of these reasons, Shure respectfully requests the Commission not to gamble with the future of the television spectrum, including DTV service and LPAS operations, and to refrain from permitting unlicensed devices to operate in the TV broadcast bands.

Respectfully submitted,

SHURE INCORPORATED

By:

A handwritten signature in black ink, appearing to read "Edgar C. Reihl". The signature is written in a cursive style with a large initial "E".

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