

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

In the Matter of	)	
	)	
Promoting Spectrum Access for Wireless Microphone Operations	)	GN Docket No. 14-166
	)	
Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions	)	GN Docket No. 12-268
	)	
	)	

**COMMENTS OF ADEUNIS RF AND ADEUNIS-NA, INC.**

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## Table of Contents

<b>I. INTRODUCTION AND SUMMARY</b> .....	3
<b>II. BACKGROUND</b> .....	4
A. Wireless Microphones in the United States and the Wireless Microphones NPRM.....	4
B. Adeunis – The Company .....	5
C. The Vokkero® Radio System.....	6
1. <i>Use of the Vokkero Radio System in Collegiate Football</i> .....	7
2. <i>Interference and the Need for More Spectrum and Common Sense Solutions for Wireless Microphones</i> .....	7
<b>III. ENGINEERING AND TECHNICAL COMMENTS</b> .....	10
A. Emission Masks and Other Technical Changes.....	10
B. Changes in the Use of the 944-952 MHz Band.....	11
C. Adding 941-944 MHz and 952-960 MHz Frequencies to the 944-952 MHz Band.....	12
D. The 902-928 MHz Band and Spread Spectrum Technology .....	12
<b>IV. CONCLUSION</b> .....	14

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Adeunis RF and Adeunis-NA, Inc. ("Adeunis"), through counsel, respectfully file comments with the Federal Communications Commission ("Commission" or "FCC"), in the above-captioned proceedings.

**I. INTRODUCTION AND SUMMARY**

On September 30, 2014, the Commission released a new notice of proposed rulemaking on how best to accommodate the needs of users of wireless microphones,<sup>1</sup> in large part, due to its restructuring of the television band and institution of incentive auctions for broadcast spectrum.<sup>2</sup> Adeunis applauds this effort and supports the FCC's specific goals that include increasing the efficient use of radio spectrum by microphone users and providing access to additional radio bands.

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<sup>1</sup> *Promoting Spectrum Access for Wireless Microphone Operations and Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 29 FCC Rcd 12343 (2014) ("*Wireless Microphones NPRM*").

<sup>2</sup> *Amendment of Part 15 of the Commission's Rules for Unlicensed Operations in the Television Bands, Repurposed 600 MHz Band, 600 MHz Guard Bands and Duplex Gap, and Channel 37, Amendment of Part 74 of the Commission's Rules for Low Power Auxiliary Stations in the Repurposed 600 MHz Band and 600 MHz Duplex Gap, and Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions*, Notice of Proposed Rulemaking, 29 FCC Rcd 12248 (2014) ("*Broadcast Incentive NPRM*"). In this rulemaking proceeding, the Commission intends to repurpose some radio spectrum that often has been used for wireless microphones, which, along the increased usage of such devices, would create a greater need for spectrum that can be used by wireless microphones.

In our comments, we explain our experiences using wireless microphones under the existing FCC rules, including problems and unnecessary complications; our experience under rules of the European Union's ("EU") radio regulation framework; and comment on certain radio engineering and technical questions asked by the Commission in the *Wireless Microphones NPRM*. Overall, the Commission appears to be applying more stringent requirements for wireless microphones (e.g., spectrum emission masks and recognition of international standard, as appropriate). This will result in a more efficient use of spectrum and thus more opportunities for greater growth in this market.

As explained in detail below, Adeunis makes the following recommendations to the Commission: 1) allocate additional radio spectrum for wireless microphones, both licensed and unlicensed; 2) require unlicensed wireless microphone users of the same frequency band, in the same general location, at the same time, to coordinate frequency use among themselves; 3) require the use of spectrum emission masks, as appropriate, by wireless microphones; 4) adopt a 500 kHz channel limit, rather than a 200 kHz limit; 5) include modulation bandwidth requirements in the rules; 6) allow wireless microphone users to operate as Low Power Auxiliary Stations ("LPAS") under the auspices of an operator of a large venue's Part 74 license, without further FCC approval; 7) increase the size of the 944-952 MHz band, by adding the 941-944 and 952-960 MHz frequencies thereto; and 8) define transient requirements for spread spectrum operation in the 902-928 MHz band, along with a bar against the operation of base stations with synchronization of multiple "hopping" systems, and in the inclusion of an appropriate duty cycle limit. Adeunis submits adoption of these recommendations will meet the Commission's goals in this proceeding and better serve the public interest.

## **II. BACKGROUND**

### **A. Wireless Microphones in the United States and the Wireless Microphones NPRM**

The FCC notes it has regulated wireless microphones in a manner (particularly by limiting transmission power) that minimizes the potential for harmful interference to other users, most

especially to primary users of the same spectrum. However, increased use of wireless microphones is, obviously, creating a higher risk of interference, including risks to microphone users themselves.

Moreover, through its efforts to make the television band more efficient and, as such, open more spectrum available to wireless broadband services, the Commission is removing some wireless microphone spectrum from future use. Specifically, the FCC wants to reduce the broadcast band to about 20 channels of 6 MHz each, with other spectrum being reallocated and reassigned by the FCC. Also affecting the market for wireless microphones is federal legislation that provides for "incentive auctions" where TV broadcast licensees can share in the proceeds from auctions of their licensed spectrum. All and all, there will be less radio spectrum available to wireless microphone users unless the FCC takes further action.

Thus, we have increased demand for wireless microphones, coupled with reduced spectrum for those devices. This mismatch is not a desirable result. Accordingly, the Commission opened this proceeding to address the mismatch and seeks comments on a number of issues, including the overall framework for addressing wireless microphone needs; promoting advances in technology; and evaluating the use of wireless microphones in various frequency bands.

#### B. Adeunis – The Company

Founded in 1993, Adeunis RF is a French corporation engaged in the design, manufacture and marketing of wireless communications systems. Its world headquarters are located at 283 rue Louis Néel Crolles, Rhône-Alpes, 38920, France. It operates in the United States through its wholly owned subsidiary, Adeunis-NA, Inc., with its principal office at 65 Pondfield Rd., Suite 14, Bronxville, NY 10708. Adeunis' products also operate under regulations promulgated by the EU and other regulatory bodies around the world.

Adeunis offers its customers products and services in four evenly balanced ranges:

- Radio transmission modules designed for incorporation into conventional electronic equipment.
- Finished products ("off the shelf" products, also called "ready to use" solutions), tested, packaged and certified for pairing with customer solutions.

- Wireless, hands-free, multiuser audio conference systems with noise filtering and no fixed base unit.
- Metering solutions such as RF W-Mbus Counters, repeaters and gateways for electricity, gas, water and heating system markets.

While Adeunis may be best known in North America for its radios used in sporting events, the Company also offers radio solutions for energy efficiency; manufacturing; automation, security and control; transportation and infrastructure; and consumer markets. Adeunis is a leading radio technology company worldwide.

### C. The Vokkero<sup>®</sup> Radio System

Adeunis offers its Vokkero radio system<sup>3</sup> for use in major sporting events throughout the world. The Vokkero radio system is an all-in-one, full-duplex, hands-free communication system that enables individuals to speak to each other, using a private and portable wireless network. The system can be set up in minutes and requires no base station or license, as it operates on unlicensed Part 15 spectrum as an “intentional radiator” (“Part 15C device”). Specifically, it operates more than twenty-five 500 KHz channels within the 902-928 MHz band, transmitting and receiving signals between 902.25 MHz and 927.75 MHz, at 0.233 Watts of power. Its signals have a range of approximately 400 meters in an open field environment allowing up to 100 meter communications in a major college football stadium or indoor building, such as a basketball or hockey arena. The Vokkero system’s high-performance noise filter ensures optimal sound quality in noisy environments.

In Europe and other parts of the world, Adeunis has sold the Vokkero radio system to many customers, especially those in competitive sports. One of the leading uses of the product is by soccer referees in major competitions such as the World Cup and the Champions League. The radio is also used by all of the best European-wide and nationwide leagues, as well as by many leagues and tournaments in the Americas that belong to, or are affiliated with, the Confederation of North, Central American and Caribbean Association Football (“CONCACAF”). Additionally, use of the

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<sup>3</sup> FCC Identifier U3Z-ARF7672.

Vokkero radio system has spread to other sports, including American football, ice hockey, rugby, basketball, field hockey, and competitive sailing.

*1. Use of the Vokkero Radio System in Collegiate Football*

In 2012, the National Collegiate Athletic Association (“NCAA”) granted a waiver to the Southeastern Conference (“SEC”) and to the Big Ten Conference (“Big Ten”) to permit the entire officiating team of referees to test the Vokkero radio system during certain football games. Then-existing NCAA football rules permitted only the head referee to wear a microphone. The goals of the test were to “identify pre-snap reads, become more efficient in enforcing penalties without huddling, and explain rulings better to coaches.”<sup>4</sup> These improvements can result in better officiating and fewer game delays, similar to what has been found with soccer officiating. The use of the system by officials can also contribute to better player safety.

Using the NCAA waiver, those two major football conferences tested the Vokkero radio system during the 2012 Spring football practice season,<sup>5</sup> and the SEC continued its test during their 2012 regular season. A goal of the test was to determine whether the system could function without receiving interference from other RF devices. In 2013, the NCAA changed its rules to allow officiating crews to utilize a protected wireless communication system, beginning with the 2013 football season. The Vokkero radio system was utilized in all SEC games during the 2013 football season and in 2014 by the SEC and the Big Ten Conferences.

*2. Interference and the Need for More Spectrum and Common Sense Solutions for Wireless Microphones*

As noted above, Adeunis has substantial and recent experience operating its low-power

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<sup>4</sup> [http://www.al.com/sports/index.ssf/2012/07/sec\\_will\\_try\\_wireless\\_communic.html](http://www.al.com/sports/index.ssf/2012/07/sec_will_try_wireless_communic.html).

<sup>5</sup> [http://espn.go.com/college-football/story/\\_/id/8314421/sec-officials-wear-wireless-microphones-thursday-game-south-carolina-gamecocks-vanderbilt-commadores](http://espn.go.com/college-football/story/_/id/8314421/sec-officials-wear-wireless-microphones-thursday-game-south-carolina-gamecocks-vanderbilt-commadores). The Vokkero radio system has been used in high school football as well. “The Alabama High School Athletic Association (“AHSAA”) ... demonstrate[ed] a new approach to officiating Friday night as top-ranked Muscle Shoals visit[ed] Cullman for the final Class 5A, Region 8 game of the season” in October 2012. The Vokkero radio system was used by game officials. <http://www.cullmantimes.com/local/x253554419/Cullman-game-will-feature-equipment-test-for-officiating-crew>.

wireless microphones in mission-critical environments, such as football games where referees need to communicate quickly and clearly to keep the game moving, to avoid “bad” officiating calls, and to help prevent player injuries. Based on this experience, we support the FCC’s intention to revise its rules to make the operation of such devices more effective and efficient. Further, there needs to be more spectrum made available for wireless microphones and the institution of common sense practices to prevent interference among low-power devices using the same spectrum.

As the Commission is well aware, Adeunis was unable to operate its wireless microphones in the 902-928 MHz band for the last two collegiate football seasons. During tests, Adeunis and a major competitor that provides similar wireless microphone systems to coaching staffs for communication during football games experienced interference from each other’s systems. That is, both systems experienced interference from the other despite their low-power operations because they were sharing channels. Of course, the inability of game officials or a college coaching staff to communicate privately, clearly, and timely among themselves is not acceptable. Interference can allow coaches to hear their opponents; one side or the other hearing confidential discussions among game officials; or being unable to communicate important messages in a timely manner.

On several occasions, Adeunis attempted informal discussions with its competitor to allocate Part 15 spectrum “informally,” but to no avail. Because it cannot allow the security of football referees’ conversations to be compromised, Adeunis was compelled to seek and obtain two grants of Special Temporary Authority (“STA”) for the 2013 (SEC) and 2014 (SEC and Big Ten) football seasons. Call Sign WG9XXH, File Number 0772-EX-ST-2013 (2013 Season). Call Sign WH9XSZ, File Number 0630-EX-ST-2014 (2014 Season). Those grants enabled the Vokkero radios to operate on in the 901-902 MHz band.<sup>6</sup>

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<sup>6</sup> It is important to note the Vokkero radio system also works within the EU’s 863-870 MHz band, as well as the FCC’s unlicensed 902-928 MHz band. Operation outside the range of 820-960 MHz would necessitate a costly redevelopment of the entire radio system, something Adeunis’ management would like to avoid.

Adeunis respectfully submits the status quo is unacceptable and needs to be addressed by the FCC. While Adeunis agrees Commission policies that rely on technological advances and competitive markets are generally a better result than government fiat, the current framework for the 902-928 MHz band (unlicensed use) simply is not working satisfactorily in the sporting events milieu. Wireless microphone manufacturers should not be forced to choose between accepting the risk of interference by competitors' microphones (which impairs the value of the microphone systems to end user customers—here, college coaches and referees) or incurring extra costs by seeking an STA to operate on a different band. There needs to be something between a regulatory straightjacket and the "Wild West."

In most situations, Adeunis expects low-power microphone systems could easily share channels in the same unlicensed band with a simple agreement. Further, since they are sharing a public resource (here, the 902-928 MHz band), it is simply wrong for competitors not to sit down voluntarily and work out a fair plan to divide channels.<sup>7</sup> Accordingly, the FCC may well wish to consider a rule change that requires competing wireless microphone users of the same unlicensed frequency band, at the same time, to attempt to negotiate an informal channel-sharing agreement. Adeunis sees no reason why three separate, low-power, wireless microphone systems cannot share the 902-928 MHz band, especially if Commission rules required common sense discussions among the unlicensed users.

Another important solution for unnecessary interference among wireless microphones is, as the FCC recognizes, to allocate more radio spectrum to the operation of unlicensed devices. Adeunis' worldwide experience with wireless microphones strongly indicates there will be more demand for such devices in the future, such that the FCC needs to expand available radio spectrum

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<sup>7</sup> Adeunis is not suggesting herein that low-power, unlicensed Part 15 devices be permitted to cause interference with licensed devices. Such a result is unacceptable, but also quite unlikely, given the strict power limits on Part 15 devices. Indeed, Adeunis submitted analyses with its two applications for STAs that showed the Vokkero radios, operating with 0.23 Watts of power, would not likely cause any interference to licensed users of the 901-902 MHz band.

for unlicensed devices, even beyond the frequencies that Adeunis cannot use easily today.

### III. ENGINEERING AND TECHNICAL COMMENTS

As a leading manufacturer of radio systems, including wireless microphones, Adeunis employs world-class radio doctors (Ph.D.), engineers and technicians, with significant knowledge of the technical issues raised by the Commission in the *Wireless Microphones NPRM*. Accordingly, Adeunis offers comments on some, but not all, of the Commission's questions in order help advance its goals of more efficient and effective use of wireless microphones in the public interest.

#### A. Emission Masks and Other Technical Changes

The Commission, in seeking to promote more efficient use of available channels in the TV band spectrum, proposes to require all wireless microphones "to comply with the applicable ETSI standards (Section 8.3 of ESTI EN 300 442-1) for analog and digital wireless microphones that operate over 200 kHz channels."<sup>8</sup> Adeunis agrees that the use of the emission masks as described in Section 8.3 of ETSI EN 300 422-1 will likely result in a more efficient use of the spectrum.

However, we disagree that 200 kHz channel limits are sufficient. A larger Bn (Necessary Bandwidth) is needed, based on our experience. Indeed, more and more digital wireless microphone systems are based on a TDMA (Time Division Multiple Access) scheme that necessarily require High RF data rate transmissions. For example, in a 400 kHz channel, more than 20 devices can communicate at 230.4 kbps. Accordingly, Adeunis recommends a 500 kHz channel limit be adopted. Such a rule will address the growth in larger microphone "networks," avoid the need to process applications for waiver, and, overall, simplify spectrum sharing. Indeed, allowing the "TDMA approach" will suppress up and down channels randomly placed in the entire band for each device on a system. Thus a complete system can be operated within a 500-kHz channel, allowing others users' systems to use the rest of the allocated band. It will be easier to measure frequency band

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<sup>8</sup> *Wireless Microphone NPRM*, at ¶189. The FCC makes a similar recommendation with respect to the use of emission masks in the 944-952 MHz band. *Id.*, at ¶139. Adeunis agrees the use of ETSI emission masks will have a similar result in the 944-952 MHz band.

occupancy with this approach.

Also, the FCC asks whether other rule revisions for microphone operations would improve effectiveness and efficiency.<sup>9</sup> Adeunis recommends the Commission adopt modulation bandwidth requirements, as discussed in ETSI EN 300 220-1 §7.7, to increase the efficient use of the spectrum.

#### B. Changes in the Use of the 944-952 MHz Band

The Commission asks a number of questions about the use of licensed microphones in the 944-952 MHz band.<sup>10</sup> In paragraph 137, the FCC asks for information about use of these licensed devices (Low Power Auxiliary Stations or “LPAS,” including wireless microphones) in specific venues. Adeunis believes that the rules should permit licenses granted to operators of large outdoor and indoor venues, such as sports stadiums, auditoriums or arenas or convention centers, to allow third parties to operate low-power, wireless microphones, such as the Vokkero radio systems, during a sporting event without further FCC approval. For example, assume a major university obtains a Part 74 low power system license for operation at its football stadium for telecasting or cablecasting of home football games. While many of the licensed devices (LPAS) would be used by a broadcaster or cable channel, there is still room for purveyors of wireless microphones, such as Adeunis and its competitors, to use the same spectrum at low power, e.g., 250 milliwatts for equipment worn on the body. The spectrum can accommodate the use of an officials’ radio system and two coaches’ systems, as well the TV devices.

Further we see no need for the low-power microphone users to obtain any operating authority from the FCC. The Commission is already regulating the large venue operator, which has an interest in ensuring the seamless operation of all radio and TV systems. Such a licensee can certainly be expected to work with all spectrum users to make sure all can operate free from

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<sup>9</sup> *Id.*, at ¶192.

<sup>10</sup> *Id.*, at ¶135, *et seq.*

interference. There is no need for additional regulations of LPAS devices.<sup>11</sup>

C. Adding 941-944 MHz and 952-960 MHz Frequencies to the 944-952 MHz Band

The FCC effectively proposes to enlarge the 944-952 MHz band by allowing unused portions of the 941-944 MHz and 952-960 MHz bands for licensed microphones under existing Part 74 rules.<sup>12</sup> Adeunis supports this proposal. As explained earlier, the Vokkero radio system is engineered to take the greatest advantage of both the EU's and FCC's regulations. As such, the radio can operate within the proposed expanded band of 941-960 MHz without the necessity and expense of a major redesign. Logic suggests Adeunis is not alone, such that other manufacturers could take similar advantage of the larger spectrum band for their products. We urge adoption of the larger band as a means to provide greater access to wireless microphones in the market, without the risk of higher costs and prices to customers.

Adeunis does, however, respectfully submit that a 200 kHz channel limit as proposed in paragraph 150 is insufficient. Using TDMA technology, a 500 kHz channel would provide a higher quality of service for as many as 20 devices (25 kHz individual channels), which, in turn, gives users more flexibility. This better serves the public interest.

D. The 902-928 MHz Band and Spread Spectrum Technology

In the 902-928 MHz band, the Commission notes there is a hierarchy of users and the raises the question of the use of spread spectrum technology.<sup>13</sup> Adeunis has developed a wireless microphone system in the 902-928 MHz band, in compliance with Section 15.247, that uses a "frequency hopping," spread spectrum approach. So far, the results have been excellent, except for

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<sup>11</sup> In drawing this conclusion, Adeunis believes the FCC would regard the Vokkero radio system, using TDMA technology, as a compliant LPAS device; the Vokkero radio system could operate at a power level not to exceed one Watt; and would not be restricted to a channel limit of 200 kHz. See 47 C.F.R. §74.861. We urge the Commission to confirm this understanding as "correct," or, if not correct, amend the rule (74.861) to allow wireless microphones to operate as LPAS with the conditions set forth in this footnote.

<sup>12</sup> *Id.*, at ¶149.

<sup>13</sup> *Id.*, at ¶¶161-62.

the following problem. When using this system in a football stadium, we have found energy is transferred to adjacent channels when the radio "hops" from one channel to another. We believe this occurs because Section 15.247 does not define transient requirements for spread spectrum systems. ETSI standards, such as EN 300 220, define transient requirements and allows good spectrum sharing. Accordingly, it should be adopted by the FCC.

Adeunis had also seen some spread spectrum systems use base stations, which allows them to synchronize as many as four "hopping systems." This configuration guarantees good operation of the first synchronized system, but creates a difficult RF environment and can prevent other systems to operate satisfactorily. The status quo has effectively created a "first-in-time is first-in-right" environment. To avoid this result, the Commission should forbid the synchronization of several hopping systems in the place by any one user.

We also recommend the FCC include a duty cycle limit is required in Commission rules. Such limit is imposed by the EU and works well for all users.

#### IV. CONCLUSION

For the reasons discussed above, the FCC should expand the radio spectrum available for use by wireless microphones and incorporate Adeunis' recommendations into revised rules affecting such devices.

Respectfully submitted,  
Adeunis RF and Adeunis-NA, Inc.



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