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December 17, 1999

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**FEDERAL COMMUNICATIONS COMMISSION  
OFFICE OF THE SECRETARY**

BY HAND

Magalie Roman Salas, Secretary  
Federal Communications Commission  
445 Twelfth Street, S.W. - Suite TW-A325  
Washington, D.C. 20554

Re: WT Docket No. 99-168 and WT Docket No. 96-86  
*Written Ex Parte Presentation*

Dear Ms. Salas:

Transmitted herewith are four copies of a written *ex parte* presentation by FreeSpace Communications (FreeSpace) for inclusion in the public record of the two above-referenced proceedings. This presentation describes in detail FreeSpace's proposal for frequency coordination and other safeguards to ensure that commercial services do not cause interference to public safety communications.

Sincerely,



Charles W. Logan

Enclosure

cc:	Ari Fitzgerald	Mark Schneider
	Bryan Tramont	Peter Tenhula
	Adam Krinsky	Dale Hatfield
	Julius Knapp	Thomas Sugrue
	James Schlichting	Kris Monteith
	Marty Liebman	Jay Jackson
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## FREESPACE COMMUNICATIONS

### Frequency Coordination and Other Measures to Protect Public Safety

FreeSpace Communications (FreeSpace) has proposed in a recent filing that commercial licensees of the 1.5 MHz guard bands adjacent to the public safety bands should be required to frequency coordinate with public safety frequency coordinators to maximize the protection from interference to public safety operations. In this memo, FreeSpace provides specific details about how such a requirement would eliminate interference. This memo also summarizes all of the interference safeguards FreeSpace has proposed. These comprehensive safeguards provide maximum interference protection for public safety communications. In fact, FreeSpace believes these safeguards, taken together, provide greater protection than proposals that have been made that would limit the use of the guard bands to high-powered, wide-area PMRS systems.

#### Introduction

By embracing frequency coordination as an effective technique to avoid and resolve interference concerns, the FreeSpace proposal would place the complete set of protection measures provided by frequency coordination at the service of the public safety and commercial entities occupying adjacent bands. In particular, the Motorola draft revisions to Part 27 of the Commission's rules state that<sup>1</sup>

Licensees in the bands 746 to 747.5 MHz, 762.5 to 764 MHz, 776 to 777.5 MHz and 792.5 to 794 MHz must develop frequency coordination procedures in cooperation with the FCC's designated frequency coordinator of the public safety allocation at 764-776/794-806 MHz in order to protect public safety operations. At its discretion, the FCC may request that licensees in the bands 746 to 747.5 MHz, 762.5 to 764 MHz, 776 to 777.5 MHz and 792.5 to 794 MHz provide documentation to the Commission on the developed procedures on a case-by-case basis. In addition, licensees in the bands 746 to 747.5 MHz, 762.5 to 764 MHz, 776 to 777.5 MHz and 792.5 to 794 MHz are required to cooperate in the selection and use of frequencies in order to reduce interference and are required to cooperate to resolve any interference through mutually satisfactory arrangements.

It has been proposed by some parties that licensees of the bands 746 to 747.5 MHz, 762.5 to 764 MHz, 776 to 777.5 MHz and 792.5 to 794 MHz (collectively, the "guard bands") be restricted to PMRS band managers. Such a restriction, however, is not necessary to protect public safety communications. The Commission should permit commercial entities such as FreeSpace to bid for the use of the guard bands, provided that strong interference protection measures are stipulated to protect public safety operations. As summarized at the end of this memo, FreeSpace has proposed a number of such protection measures that it believes will provide stronger interference protection than the proposals to restrict the guard bands to PMRS. By *further* requiring commercial licensees to abide by the above frequency coordination requirements, the Commission

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<sup>1</sup> Letter of Steve Sharkey, Motorola, Inc., to Magalie Roman Salas, WT Docket No. 99-168, attachment 2 (filed Dec. 13, 1999).

would hold commercial and private licensees to the same standards, thereby ensuring complete protection to public safety operations.

This is particularly true because the necessary coordination procedures would be developed in cooperation between the guard band licensee and the designated public safety coordinator and because the licensee would be required to cooperate to resolve interference issues, should they arise. The public safety community would thus have an integral, essential, ongoing role in developing procedures that achieve the desired protection. The development of such procedures is possible whether the guard band system is a commercial or a private system. The Commission must strive to adopt service-neutral technical rules that recognize this fact.

In the following paragraphs, FreeSpace describes some of the types of measures that might be taken by coordinating parties under this proposal to eliminate interference. It should be noted that it is not possible to enumerate all of the available measures, due to the flexible nature of Motorola's proposed frequency coordination rule. Thus, it is not our intent to limit what procedures licensees can develop in conjunction with the public safety community, but rather to provide concrete examples that demonstrate the effectiveness of coordination as applied to commercial licensees of the guard bands.

### **Traditional Frequency Coordination Tools**

Frequency coordination allows licensees in adjacent bands to employ a number of measures to eliminate interference across their shared band edge. Such measures have traditionally included restrictions on site placements, antenna heights, antenna gain directivity patterns and frequency channel assignments. These measures can prevent the coordinated systems from producing adjacent channel interference and can also be used to define operational regions that isolate the emissions (including out-of-band emissions) of one system from another. When used to separate the coverage areas of the coordinated systems, these techniques can also prevent interference between mobile units of the two systems and between the mobile units of one system and the base units of the other.

In addition to the above measures, the specification of out-of-band emissions limits, though not unique to coordinated systems, is an effective and necessary adjunct that makes coordination much easier. Indeed, it is worth noting that all frequency coordinated systems are also generally required to meet specific emissions requirements that aid in the prevention of adjacent channel interference and interference to operations in other bands.

When evaluating the combined effectiveness of frequency coordination and out-of-band emissions limits, there are four possible modes of interference to consider. These are,

- Interference from a guard band base into a public safety base.
- Interference from a guard band mobile into a public safety base.
- Interference from a guard band mobile into a public safety mobile.

- Interference from a guard band base into a public safety mobile.

The following paragraphs demonstrate how these modes of interference can all be eliminated in the context of the FreeSpace proposal by a combination of frequency coordination, appropriate technical rules and strict out-of-band emissions limits.

### **Base-to-Base and Mobile-to-Base**

The first potential interference mode to consider occurs between base units in the two systems. This type of interference can be eliminated a number of ways, of which frequency coordination is one technique. Often, the technical rules for systems in adjacent bands prevent this type of interference by a judicious arrangement of transmit and receive bands. For example, the reversed band plan proposed by Motorola in this proceeding designates the 792.5-794 MHz guard band as a PMRS base unit transmit band. By also designating the adjacent public safety band from 794-806 MHz as a base unit transmit band, the technical rules would eliminate any possibility of guard band base units from interfering with public safety base units across the 794 MHz interface. In contrast, the same band plan designates the 776-777.5 MHz guard band as a PMRS base unit transmit band while designating the adjacent 764-776 MHz public safety band as a base unit *receive* band. This opens the possibility of interference between PMRS base units and public safety base units across the 776 MHz boundary. Frequency coordination, in this instance, would be required to resolve possible interference between the bands.

To achieve resolution in situations like this, the coordinating parties can specify a combination of site locations, antenna heights, and antenna down tilts and beam patterns that removes the interference threat. Such measures should, of course, also be available to commercial licensees of the guard bands. In the case of a very low-power system, such as the one proposed by FreeSpace for use in the guard bands, the coordinating parties could use these techniques to carve out protective exclusion zones around public safety sites to eliminate any possibility of base-to-base interference. Due to the short range of the low power guard band units, these zones would be reasonably sized so that this approach would not place an undue burden on the commercial licensee.

In addition to guarding against base-to-base interference, the definition of exclusion zones would protect public safety bases from the emissions of guard band mobile units. Because these mobile units can only function while in the coverage area of their own bases, mobile-to-base interference would be eliminated due to coverage gaps in the exclusion zones.

### **Base-to-Mobile**

Another possible mode of interference is that of a guard band base unit interfering with a public safety mobile unit. A powerful technique for eliminating this interference mode is

to specify stringent out-of-band emissions limits in the public safety mobile receive band. As described in technical detail in a previous filing,<sup>2</sup> FreeSpace has demonstrated that an attenuation of  $84+10\log_{10}(P)$  below the full-bandwidth carrier power, P, as measured in a 6.25kHz bandwidth is sufficient to virtually eliminate this source of interference to public safety units. Even at the very boundary of the public safety system coverage area, this attenuation would provide a very high confidence level that no interference will occur.

By incorporating frequency coordination, any remaining uncertainty can be removed. For example, the coordinating parties could specify that no guard band base units be deployed within a certain distance of the public safety coverage area boundary. In this fashion, the public safety mobile units that are most susceptible to interference would be protected from exposure to emissions from the guard band system. More generally, the coordinating parties may determine the locations of other marginal coverage areas and define exclusion zones to protect public safety mobile units that may wander into those areas. Thus, a combination of frequency coordination and stringent out-of-band emissions limits would completely eliminate this potential source of interference.

In a recent filing, APCO has expressed a concern that there may be an "absence of site-specific licensing for [FreeSpace] transmitters" and that FreeSpace may "lack ... control over transmitter location and movement." FreeSpace wishes to allay these concerns. FreeSpace will know the precise location of every base unit, as it must for its own network planning purposes. Each of these units will be outdoors, immobile, and stationary. FreeSpace will know the exact location of these units, and, in addition, they will be equipped with GPS units. Moreover, FreeSpace will have complete network control over these base stations at all times from its network operations centers. It is also important to understand that the number of these base units will be limited and that the vast majority of FreeSpace units in operation will be subscriber mobiles which will not interfere with public safety mobiles, as discussed in the next section. A FreeSpace base unit will be installed in a fixed location and from that location serve a radius of approximately 1 to 2 km, making it unnecessary to install a large number of base stations. The frequency coordination process will dictate where these installations will be permitted. Furthermore, these base stations are very inexpensive and compact, which means that they can inexpensively be relocated if the frequency coordination process calls for this.

### **Mobile-to-Mobile**

The final mode by which public safety units could potentially receive interference is for a guard band mobile unit to interfere with a public safety mobile unit. The most direct way to eliminate this source of interference is to adopt technical rules that would exclude the guard band mobile units from transmitting in bands immediately adjacent to the public safety mobile receive band. In addition, mobile-to-mobile interference can be eliminated

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<sup>2</sup> Letter of Charles Logan, Lawler, Metzger & Milkman, to Magalie Roman Salas, WT Docket No. 99-168 (filed Dec. 17, 1999).

in the frequency coordination process by separating the coverage areas of the two systems through site restrictions.

In summary, as the previous paragraphs describe, it is possible to eliminate all modes of interference to public safety units through a combination of frequency coordination, appropriate technical rules and out-of-band emissions limits. This comprehensive approach would permit the operation in the guard bands of a low-power commercial service, such as that proposed by FreeSpace, while providing complete protection from interference to public safety units in the adjacent bands.

### Frequency Coordination Database and Network Automation

For frequency coordination to be most effective, it is important that information on site placement and channel usage by both parties be up to date and easily accessible. In the 700 MHz public safety proceedings, the FLEWUG had expressed its support for the development and use of a common coordinator database for use in formulating frequency recommendations. The FLEWUG went on to say that such a database is reasonable, achievable, and appropriate given the current state of database technology, the essential need for accurate and consistent frequency information, and the increased need for the timeliness of this information created by heightened competition among the coordinators.<sup>3</sup> FreeSpace agrees that such a database would be very useful, particularly for the purpose of frequency coordination in the context of FreeSpace's technology.

Thus, FreeSpace proposes the creation of a common database, which would contain information on site locations and frequency channel usage in the guard bands, as well as information on site locations and frequency channel usage in the 700MHz public safety spectrum. FreeSpace would take advantage of such a database as one means of ensuring constant compliance with the coordination requirements developed in cooperation with the designated public safety frequency coordinator. FreeSpace will know the exact location of every base unit in the system, each such unit will be equipped with a GPS unit, and all units are under network control at all times. Note that the base units are outdoors, immobile and stationary. Because the units dynamically select what channels to operate on, they can be commanded over the network to restrict their operation to a particular set of frequency channels to avoid interference. Such restrictions can be placed on any particular unit within a matter of seconds as necessary. For example, as new public safety installations are installed or brought on-line or as new guard band systems are installed, the availability of an up-to-date, electronic database would enable the FreeSpace system to configure itself appropriately and rapidly, according to the coordination agreements in effect. This approach would provide superior protection to current and future public safety systems. In addition, the ability of FreeSpace to remotely configure its installations will permit a rapid response to any concerns about interference that may arise in the field. Finally, FreeSpace also supports a mandate that licensees of guard band spectrum maintain a toll-free telephone number that is monitored around-the-

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<sup>3</sup> FLEWUG Petition for Reconsideration and Clarification in WT Docket No. 96-86, at ES-3 (filed Dec. 2, 1998).

clock to facilitate rapid response to public safety coordination needs, whether or not such a database is available.

## Summary of Protection Measures

FreeSpace has proposed a comprehensive set of safeguards that will ensure that public safety communications are protected against interference by commercial services operating in the guard bands. To summarize, the safeguards are as follows:

- FreeSpace proposes that guard band licensees be required to develop frequency coordination procedures with the designated public safety frequency coordinator in accordance with section 27.60 of the Motorola proposed draft revisions to Part 27 of the Commission's rules.
- FreeSpace supports the adoption of Motorola's proposal of a -57dBm out-of-band emissions limit, or, equivalently, a requirement that a guard band licensee attenuate its out-of-band emissions by a factor of not less than  $87 + 10 \log(P)$  in a 6.25 kHz bandwidth, where P is the transmitter power in watts. This limit would specifically apply to base transmitter units in the guard bands adjacent to the public safety mobile receive band.
- FreeSpace proposes a transmit power spectral density limit of 4mW/kHz for transmitters operating in the guard bands immediately adjacent to the public safety bands. This limit would apply for antenna gains up to 6dBi, with a required backoff of 1dB for every 1dB increase in antenna gain beyond this point.
- FreeSpace proposes that the Commission require the use of active power control in the guard bands adjacent to public safety spectrum to further reduce the opportunity for interference to occur.
- FreeSpace proposes a restriction barring the use of direct sequence spread spectrum systems to ensure that the aggregate power of multiple guard band units will never exceed the specified power spectral density limits for a single unit.

FreeSpace believes that, collectively, these measures would provide complete protection to public safety operations. Indeed, these measures provide greater protection than the proposals to restrict the guard bands to high-powered, wide area PMRS systems. The combination of a low-power system with strict out-of-band emissions limits coupled with frequency coordination between the commercial provider and public safety frequency coordinators combines the strongest technical rules to ensure that public safety communications are interference free.

The Commission can, and should, adopt service-neutral technical rules that permit the use of the 1.5 MHz guard bands for commercial purposes as required by section 337(a)(2) of the Communications Act.<sup>4</sup>

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<sup>4</sup> 47 U.S.C. § 337(a)(2).