

**Before the  
Federal Communications Commission  
Washington, DC 20554**

In the Matter of:	)	
	)	
Unlicensed Use of the 6 GHz Band	)	ET Docket No. 18-295
	)	
Expanding Flexible Use in Mid-Band Spectrum	)	GN Docket No. 17-183
Between 3.7 and 24 GHz	)	

**COMMENTS OF MOTOROLA SOLUTIONS INC.**

Motorola Solutions Inc. (MSI) submits these comments in response to the Notice of Proposed Rulemaking (NPRM) in the above captioned proceeding.<sup>1</sup> The NPRM seeks comment on proposed rules to implement automated spectrum sharing by unlicensed devices in the 6 GHz band used for critical fixed microwave links and many other services.<sup>2</sup> MSI fully appreciates the complexity of attempting to enhance the utilization of more than a gigahertz of spectrum that is already heavily occupied. MSI believes that a carefully crafted spectrum sharing approach is necessary to accomplish the Commission’s goal of sharing the band with unlicensed devices while protecting current and future incumbent operations.

The 6 GHz band is heavily utilized by numerous incumbents today, and will continue to be heavily utilized in the future. MSI reiterates that the 6 GHz band is home to numerous mission critical links for public safety and critical infrastructure services, and must be protected from harmful interference.<sup>3</sup> These links rely on very high levels of service reliability (e.g.,

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<sup>1</sup> *Unlicensed Use of the 6 GHz Band*, Notice of Proposed Rulemaking, ET Docket No. 18-295 and GN Docket No. 17-183 (rel. Oct. 24, 2018) (“*6 GHz NPRM*”).

<sup>2</sup> See 6 GHz NPRM at ¶¶1-2.

<sup>3</sup> See Comments of Motorola Solutions, Inc., Notice of Inquiry, GN Docket No. 17-183 at 3 (Oct. 2, 2017).

99.9999%) since they often carry traffic related to life-safety or critical equipment operations.<sup>4</sup>

Given the importance of these existing incumbent operations, MSI suggests a conservative approach to incumbent protection, as further described below. A carefully crafted spectrum sharing approach is necessary to accomplish the Commission's goals of sharing the band with unlicensed devices while protecting current and future incumbent operations.

In order to effectively share the spectrum, MSI supports employing cloud-based Automated Frequency Coordination (AFC) mechanisms. This approach will best allow critical updates to protection information (such as new or modified incumbent operations, interference protection levels, shut down of interfering devices, etc.) to be made in a timely and effective manner. While we understand the desire to give unlicensed devices the ability to determine available spectrum locally, MSI believes that these techniques will make it difficult to ensure that critical changes to protection methods or data are enacted in a timely manner.<sup>5</sup> For example, the Commission has already encountered significant challenges in relying on unlicensed devices to effectively implement software-based control of equipment operating in the 5 GHz bands in order to protect incumbent Doppler weather radar equipment. The 6 GHz band would pose considerably more challenges since the number of incumbents is greater and the types of incumbents are more varied.

A cloud-based AFC mechanism would allow *timely* and *universal* updates, as higher powered unlicensed equipment would be required query the cloud AFC function periodically,

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<sup>4</sup> See Reply Comments of Motorola Solutions, Inc., Notice of Inquiry, GN Docket No. 17-183 at 3 (Nov. 15, 2017).

<sup>5</sup> Changes to protection information could include, but are not limited to: new or modified information regarding incumbent link siting, incumbent receiver antenna patterns, pointing angles, interference protection ratios, etc.; unlicensed device power levels, antenna patterns, denial of authorization to operate for uncertified or mal-functioning unlicensed devices; improved propagation models, clutter/building modeling information, etc. Updating all of these quantities in a uniform and timely manner would be very difficult for millions of fielded devices.

likely on a daily basis, and will rely on the same incumbent information, protection computations and methods for all devices in the band. This would be extremely difficult to enforce in a band with AFC mechanisms distributed in millions of devices, especially in a timely manner. As in other shared bands, unlicensed devices that are unable to access a cloud-based AFC function must be required to shut down after a reasonable period of time (such as 24 hours). Cloud-based AFC methods can also be utilized to selectively shut down a group of devices in areas where an incumbent experiences interference, or even disable particular devices (or classes of devices) that are functioning improperly and causing interference.<sup>6</sup> This level of command and control is not available with device-centric AFC functions.

In regards to interference protection ratios for incumbent equipment, MSI believes that a carefully selected interference to noise (I/N) protection ratio is essential. The effects of aggregate interference from tens, hundreds, or thousands of unlicensed devices in an area can have a significant effect on raising the noise floor for critical incumbent 6 GHz links, as interference effects are generally additive. Since the 6 GHz NPRM is not proposing to consider the effects of aggregate interference on fixed links, which can be significant, *conservative* interference protection ratios must be utilized to protect critical links in the 6 GHz band. To be clear, MSI would strongly support the use of aggregate interference protection computations for incumbents, but in the absence of considering the effects of aggregate interference, the interference protection ratios must be conservative. We do not believe that the proposed (e.g., 10 dB) degradation to the 6 GHz link fading margin is appropriate, since it will significantly degrade link reliability levels for critical services. MSI therefore recommends that the

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<sup>6</sup> These methods may require unique device identifiers (e.g., serial numbers or FCC IDs) to be exchanged with the cloud-based AFC function, as is done in other bands (e.g., CBRN). For example, a series of unlicensed devices with known bad firmware can be disabled through a cloud-based AFC function.

interference protection ratio for protecting critical incumbent links be set no higher than -12 dB I/N levels. This level is the same protection that the Commission afforded non-mission critical fixed satellite service (FSS) links for *aggregate interference* levels in the recent CBRS proceeding.<sup>7</sup> The protection of terrestrial fixed links, many of which serve mission critical functionality for first responders and critical infrastructure industries, deserves equal if not greater consideration.

The interference protection modeling employed by the AFC function should also conservatively take into account the effects of unlicensed devices given any location errors (and assume the worst case location scenario given the level of uncertainty). More accurate interference modeling can be performed by the AFC functions when the actual unlicensed device transmit power levels, antenna heights (e.g., elevation above ground), and antenna patterns are provided and utilized in the protection computations. We expect that a majority of unlicensed devices will employ omni-directional antennas, however, some equipment will undoubtedly utilize directional antennas, as is common in other unlicensed bands. These effects can have very significant impacts on the interference protection computations. In addition, 3-dimensional modeling of antenna patterns and propagation paths (incorporating terrain, and clutter effects) will also greatly improve the accuracy of the modeling performed in the AFC function. With Commission oversight, and industry accepted modeling techniques (as developed by a multi-stakeholder group such as WinnForum), accurate interference estimation can be achieved, which is critical to adequately protecting critical incumbent links.

MSI supports the Commission's view that more than one authorized AFC provider

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<sup>7</sup> See *Amendment of the Commission's Rules with Regard to Commercial Operations in the 3550-3650 MHz Band*, Second Report and Order and Order on Reconsideration, 31 FCC Rcd 5011 (2016) at ¶265-6, as well as 96.17(a)(2) which is derived from the -12 dB I/N interference protection ratio requirement.

should be allowed in the band (just as there are multiple traditional frequency coordinators in other bands today), and further believes that equipment manufacturers should be allowed to field their own (cloud-based) AFC function for their equipment (as long as such functions are FCC certified to operate according to stringent incumbent protection standards and methods).

A cloud-based AFC system should typically provide the maximum allowed transmit power levels per channel (for each 10 or 20 MHz channels in the U-NII-5 or U-NII-7 band) to unlicensed devices that operate in the band, taking into account all of the interference protection information and unlicensed device deployment parameters, as further described herein. MSI further believes that the AFC functions should globally be required to record the operational frequencies of the authorized unlicensed devices (i.e., standard power access points) in the band. This information should rapidly be made accessible by Commission staff in order to quickly resolve interference issues that arise in the field. Incumbents should be provided with a single point of contact to report interference issues. In cases of unmitigated interference, the offending unlicensed devices in an area should be shut down or a reduction in transmit power should be enacted in order to protect critical links. Other capabilities are also enabled by this approach. For example, if interference to fixed service links is observed in an urban area due to aggregate interference effects from numerous unlicensed devices in the area, the AFC function can employ a lower interference protection ratio (e.g., I/N of -15 dB) in that particular area to better protect incumbents. This computation can be performed immediately upon report of interference and unlicensed devices can enact the changes during the next regularly scheduled cloud-based AFC update cycle. In this manner, interference problems in the field can be quickly and effectively addressed (without having to worry about updating the AFC mechanisms in thousands or millions of unlicensed devices).

As long as standard power access points in the proposed U-NII-5 and U-NII-7 bands are under the full control of cloud-based AFC functions, the Commission's proposed transmit power level limitations are reasonable. It may even be possible to increase unlicensed client device power levels, as long as they remain under direct or indirect cloud-based AFC control. For example, the power levels of client devices may be increased to those of access points, as long as the AFC control takes into account interference from the closest possible device to an incumbent. Lower power unlicensed devices may be allowed to operate in the proposed U-NII-6 and U-NII-8 bands, though we believe they may be difficult to restrict operation to indoor areas in practice. In addition, once such devices are fielded, there is no way to control them, or restrict their operating locations. For these reasons, MSI recommends that unlicensed devices operating in these bands either be required to access an AFC function, and/or be professionally installed (in fixed configurations). The certified professional installer approach employed in the CBRN band can be utilized in the 6 GHz band to ensure that installation data (*e.g.*, transmit power levels, antenna height, patterns, pointing angles, etc.) is accurate, and there is an accountability chain if there are problems observed in the field. These types of approaches make the most sense to protect critical incumbent links throughout the 6 GHz band.

In summary, MSI believes that the 6 GHz band has the potential to support a wide range of new and innovative applications. Therefore, MSI generally supports the Commission's pursuit of a carefully crafted spectrum sharing approach that will accomplish the goal of expanded use of the 6 GHz band by secondary devices while providing sufficient protection for existing and future incumbent operations. As a critical component of this approach, MSI supports employing cloud-based AFC mechanisms that will allow rapid and uniform updates to incumbent protection information. MSI strongly believes that a carefully selected interference-

to-noise (I/N) protection ratio is essential and recommends that the ratio for protecting critical incumbent links be set no higher than -12 dB I/N levels. Finally, the Commission should take several steps to enable the efficient and safe use of this band including by requiring AFC functions to record the operational frequencies and identifiers of authorized unlicensed devices operating in the band, and providing a mechanism for timely remediation of interference events.

Respectfully Submitted,

/s/ Frank Korinek

Frank Korinek

Director of Government Affairs

Spectrum and Regulatory Policy

Motorola Solutions, Inc.

1455 Pennsylvania Avenue, N.W.

Washington, DC 20004

(202) 371-6900

February 15, 2018